Vol. 9, No. 5
March 15, 1984

Energy Research Abstracts

Abstracts 7081-9217

Technical Information Center
UNITED STATES DEPARTMENT OF ENERGY

CURRENT AWARENESS PUBLICATIONS ON ENERGY

To provide complete coverage of literature related to major Department programs, announcement publications that are comprehensive in their coverage of certain energy fields are issued regularly. All information in these publications, plus additional backup information, is included in the Energy Data Base of the Technical Information Center; all references are also available for machine searching via the on-line retrieval system, DOE/RECON, and the commercial on-line retrieval systems. Descriptions of these current awareness publications, which are supported either directly or indirectly by the DOE, appear below. Department of Energy components may receive the listed publications free from the Technical Information Center, P. O. Box 62, Oak Ridge, TN 37831. Telephone (615) 576-1303; FTS 626-1303.

PUBLICATIONS OF THE TECHNICAL INFORMATION CENTER

Energy Abstracts for Policy Analysis (EAPA)

A monthly abstract journal devoted to the analysis of energy research, conservation, and policy. Scope and coverage are limited to substantive articles or reports and emphasize the following programmatic efforts; legislative, regulatory, and other legal aspects, social, economic, and environmental impacts; regional and sectoral analyses; institutional factors, etc. *EAPA* is available from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402; domestic subscribers $6.00, foreign $7.50 per copy; annual cumulative index, domestic $10.00, foreign $12.50 per copy. The annual subscription price is $70.00 for domestic subscribers and $87.50 for foreign subscribers.

Energy Research Abstracts (ERA)

A comprehensive semimonthly abstract journal devoted to all areas of energy-related information produced by the Department of Energy, other U. S. government organizations, and foreign governments. *ERA* is available to the public on a subscription basis from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The subscription rate for the 24 semimonthly issues is $165.00 for domestic subscribers and $206.25 for foreign subscribers. A single issue costs $9.50 (domestic) or $11.90 (foreign).

DOE Patents Available for Licensing (PAL)

DOE is prepared to grant exclusive or nonexclusive, revocable licenses under DOE-owned U. S. patents and patent applications; this semiannual publication provides abstracting and indexing coverage of this literature. *PAL* is available on subscription as PB84-946800 from the National Technical Information Service (NTIS), 5285 Port Royal Road, Springfield, VA 22161. The annual subscription price is $14.00 for domestic subscribers and $28.00 for subscribers outside the North American continent; prices for single issues are $7.00 and $14.00, respectively.

The following monthly update journals are available to the public on subscription from the National Technical Information Service (NTIS), 5285 Port Royal Road, Springfield, Virginia 22161; use the identifying order number (PB- No.) when subscribing. The annual subscription rate for one volume (calendar) year (12 issues plus cumulative index) is $75.00 for domestic (North America) and $150.00 for foreign (outside North America) subscribers. A single issue is $7.00 (domestic) and $14.00 (foreign).

***Current Energy Patents (CEP)*–PB84-902800**

Provides coverage of the international patent literature, including patent applications, that concerns any aspect of energy production, conservation, and utilization.

***Energy and the Environment (EAE)*–PB84-914900**

Devoted to information on the impacts of energy-related activities and radioactive and nonradioactive pollutants on the environment.

***Fossil Energy Update (FEU)*–PB84-914600**

Devoted to information on the exploration, development, processing, and use of fossil fuels.

***Fusion Energy Update (CFU)*–PB84-915300**

Devoted to information on controlled thermonuclear fusion, including plasma and fuel research and power plant engineering and conceptual design studies.

***Solar Energy Update (SEU)*–PB84-914500**

Devoted to information on the utilization of solar energy, including biomass and tidal and wind power.

The following semimonthly bulletins are also available from the National Technical Information Service (NTIS). The annual subscription rate for one volume (calendar) year (24 issues; no indexes) is $40.00 for domestic subscribers and $80.00 for subscribers outside the North American continent; use the identifying order number (PB- No.) when subscribing. Back issues are available for $5.00 each.

***Acid Precipitation (APC)*–PB84-901000**

Covers all aspects of acid precipitation, including effects and possible control measures.

***Coal-Based Synfuels (CBS)*–PB84-901400**

Covers all aspects of conversion of coal into gaseous or liquid fuels.

***Coal Preparation and Pollution Control (CPC)*–PB84-900800**

Covers all aspects of coal preparation and cleaning and reducing pollution from its direct combustion.

***Direct Energy Conversion (DEC)*–PB84-946600**

Covers the following areas: photovoltaics, magnetohydrodynamics, electrohydrodynamics, thermoelectrics, thermionics, and fuel cells.

***Geothermal Energy Technology (GET)*–PB84-914700**

Devoted to information on the exploration, development, and utilization of geothermal resources.

***Laser Research (LAR)*–PB84-901100**

Covers all aspects of laser research and development, but excludes applications.

***Nuclear Fuel Cycle (NFC)*–PB84-913400**

Covers all aspects of the nuclear fuel cycle, both front end and back end.

***Nuclear Reactor Safety (NRS)*–PB84-913500**

Covers the following safety aspects: accident analysis, safety systems, radiation protection, decommissioning and dismantling, and security measures.

***Radioactive Waste Management (RWM)*–PB84-902900**

Covers the following management aspects: transport and storage, waste processing, waste disposal, waste storage, radioactive effluents, and shipping containers.

***Solar Thermal Energy Technology (STT)*–PB84-901200**

Covers research in materials, concentrators/receivers, salinity gradients, etc , for development of efficient and reliable solar thermal conversion systems.

***Unconventional Petroleum (UCP)*–PB84-901300**

Covers all aspects of secondary and tertiary recovery of petroleum and of oil shales and tar sands.

INTERNATIONAL ENERGY PUBLICATIONS

The Technical Information Center cooperates with the following organizations in the publication of international abstract journals: (1) International Atomic Energy Agency, International Nuclear Information System, Vienna, Austria, for *Atomindex;* (2) International Energy Agency, IEA Coal Research, London, England, for *Coal Abstracts;* and (3) International Energy Agency, Biomass Conversion Technical Information Service, Dublin, Ireland, for *Biomass Abstracts.* In each case, the cognizant foreign agency provides the non-U.S. information to TIC for inclusion in the Energy Data Base; in turn, TIC provides the U.S. information for input into the respective journal.

Atomindex

A semimonthly abstract journal providing worldwide coverage of information on nuclear science and technology. *Atomindex* is available by subscription from UNIPUB, 345 Park Avenue South, New York, NY 10010. The cost of an annual subscription, 24 semimonthly issues and semiannual and annual cumulative indexes, is $290.

Biomass Abstracts

A bimonthly abstract journal with comprehensive coverage of information in any step involved in the eventual conversion of biomass to energy. *Biomass Abstracts* is available free to Department of Energy components and contractors from the Technical Information Center. Non-DOE organizations may obtain *Biomass Abstracts* from Biomass Conversion Technical Information Service, Institute for Industrial Research and Standards, Ballymun Road, Dublin 9, Ireland, for 42 IR pounds per year. Make checks payable to the Institute.

Coal Abstracts

A monthly abstract journal providing comprehensive worldwide coverage of information in the field of coal science and technology. *Coal Abstracts* is available to Department of Energy components and contractors from the Technical Information Center. Non-DOE organizations may obtain *Coal Abstracts* from IEA Coal Research, Technical Information Service, 14-15 Lower Grosvenor Place, London SW1W 0EX, England, for 100 pounds sterling per year.

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ENERGY RESEARCH ABSTRACTS

ABOUT THE TECHNICAL INFORMATION CENTER

The Technical Information Center in Oak Ridge, Tennessee, has been the national center for scientific and technical information for the Department of Energy (DOE) and its predecessor agencies since 1946. In developing and managing DOE's technical information program, the Center places under bibliographic control not only DOE-originated information but also worldwide literature on scientific and technical advances in the energy field and announces the source and availability of this information. Whereas the literature of science is emphasized, coverage is extended to DOE programmatic, socioeconomic, environmental, legislative/regulatory, energy analysis, and policy-related areas. To accomplish this mission, the Center builds and maintains computerized energy-information data bases and disseminates this information via computerized retrieval systems and announcement publications such as abstracting journals, bibliographies, and update journals. Direct access to the Center's most comprehensive data base, the Energy Data Base, is available to the public through commercial on-line bibliographic retrieval systems. The Energy Data Base and many of the Center's energy-related data bases are available to DOE offices and contractors and to other government agencies via DOE/RECON, the Department's on-line information retrieval system. The Center has developed and maintains systems to record and communicate energy-related research-in-progress information, to maintain a register of DOE public communications publications, to track research report deliverables from DOE contractors, and to test and make available DOE-funded computer software programs with scientific and management applications. The Center also maintains a full-scale publishing capability to serve special publication needs of the Department. To effectively manage DOE's technical information resources, the Center's program is one of continual development and evaluation of new information products, systems, and technologies.

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ABOUT *ENERGY RESEARCH ABSTRACTS*

Energy Research Abstracts (ERA) provides abstracting and indexing coverage of all scientific and technical reports, journal articles, conference papers and proceedings, books, patents, theses, and monographs originated by the U. S. Department of Energy, its laboratories, energy centers and contractors. *ERA* also covers other energy information prepared *in report form* by federal and state government organizations, foreign governments, and domestic and foreign universities and research organizations. The user should remain aware that *ERA* coverage of non-report literature is limited to that generated by Department of Energy activity.

ERA is comprehensive in its subject scope, encompassing the DOE's research, development, demonstration, and technological programs resulting from its broad charter for energy sources, supplies, safety, environmental impacts, and regulation.

ERA is available on an exchange basis to universities, research institutions, industrial firms, and publishers of scientific information. Inquiries should be directed to the Technical Information Center, P. O. Box 62, Oak Ridge, Tennessee 37831.

ERA is available to the public on a subscription basis from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The subscription rate for the 24 semimonthly issues is $165.00 for domestic subscribers and $206.25 for foreign subscribers. A single issue costs $9.50 (domestic) or $11.90 (foreign). The cumulative indexes will be available in printed form from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402, and in microfiche form from the National Technical Information Service, U. S. Department of Commerce, Springfield, Virginia 22161, and from Engineered Systems, P. O. Box 866, Oak Ridge, Tennessee 37831.

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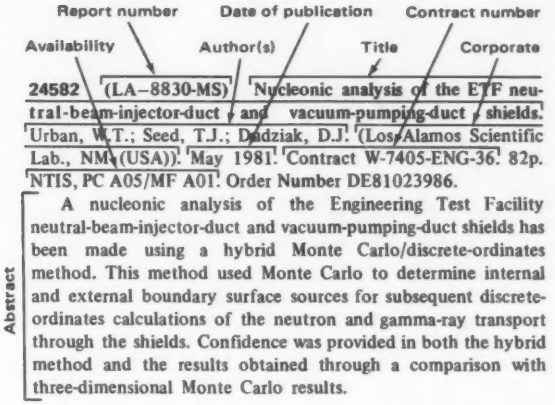
HOW TO USE *ENERGY RESEARCH ABSTRACTS*

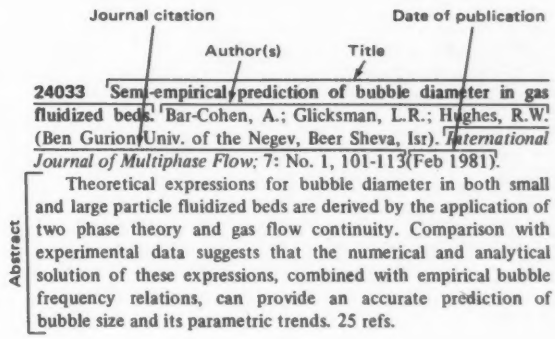
ABSTRACTS IN *ENERGY RESEARCH ABSTRACTS*

The principal elements of abstract entries for a typical research and development report and a typical technical journal article are illustrated below.



24582 (LA–8830-MS) Nucleonic analysis of the ETF neutral-beam-injector-duct and vacuum-pumping-duct shields. Urban, W.T.; Seed, T.J.; Dudziak, D.J. (Los Alamos Scientific Lab., NM (USA)). May 1981. Contract W-7405-ENG-36. 82p. NTIS, PC A05/MF A01. Order Number DE81023986.

A nucleonic analysis of the Engineering Test Facility neutral-beam-injector-duct and vacuum-pumping-duct shields has been made using a hybrid Monte Carlo/discrete-ordinates method. This method used Monte Carlo to determine internal and external boundary surface sources for subsequent discrete-ordinates calculations of the neutron and gamma-ray transport through the shields. Confidence was provided in both the hybrid method and the results obtained through a comparison with three-dimensional Monte Carlo results.



24033 Semi-empirical prediction of bubble diameter in gas fluidized beds. Bar-Cohen, A.; Glicksman, L.R.; Hughes, R.W. (Ben Gurion Univ. of the Negev, Beer Sheva, Isr). *International Journal of Multiphase Flow;* 7: No. 1, 101-113 (Feb 1981).

Theoretical expressions for bubble diameter in both small and large particle fluidized beds are derived by the application of two phase theory and gas flow continuity. Comparison with experimental data suggests that the numerical and analytical solution of these expressions, combined with empirical bubble frequency relations, can provide an accurate prediction of bubble size and its parametric trends. 25 refs.

INDEXES TO *ENERGY RESEARCH ABSTRACTS*

Five indexes are provided for approaching the contents of each issue of *Energy Research Abstracts (ERA).* Each index is preceded by an introduction that details the organization of the index and the principles by which it was compiled. The reader is referred to these introductions for information not found in the index examples that follow.

• Corporate Author Index

Technical report literature is indexed using the name of the organization or institution responsible for the issuance of the report.

24582 (LA–8830-MS) Nucleonic analysis of the ETF neutral-beam-injector-duct and vacuum-pumping-duct shields. Urban, W.T.; Seed, T.J.; Dudziak, D.J. **(Los Alamos Scientific Lab., NM (USA)).** May 1981. Contract W-7405-ENG-36. 82p. NTIS, PC A05/MF A01. Order Number DE81023986.

is indexed as:

Los Alamos Scientific Lab., NM (USA)
Nucleonic analysis of the ETF neutral-beam-injector-duct and vacuum-pumping-duct shields, 6:24582 (R:US)

• Personal Author Index

Each author's name is indexed in the form appearing on the document abstracted, with the exception that given names are reduced to initials:

Bar-Cohen, A., Semi-empirical prediction of bubble diameter in gas fluidized beds, 7:24033 (J:US)
Dudziak, D.J., *See* Urban, W.T., 6:24582
Glicksman, L.R., *See* Bar-Cohen, A., 7:24033
Hughes, R.W., *See* Bar-Cohen, A., 7:24033
Seed, T.J., *See* Urban, W.T., 6:24582
Urban, W.T., Nucleonic analysis of the ETF neutral-beam-injector-duct and vacuum-pumping-duct shields, 6:24582 (R:US)

• Subject Index

The subject index consisting of entries naming specific materials, objects, and processes is arranged alphabetically. Document titles, informative phrases, or both specific to these entries are arranged alphabetically under the entries.

TOKAMAK ETF
Neutral Atom Beam Injection
Nucleonic analysis of the ETF neutral-beam-injector-duct and vacuum-pumping-duct shields, 6:24582 (R:US)
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Nucleonic analysis of the ETF neutral-beam-injector-duct and vacuum-pumping-duct shields, 6:24582 (R:US)

• Contract Number Index

DOE technical literature is indexed using contract numbers under which the literature was produced. This index contains the contract number with corresponding abstract and report numbers.

W-7405-ENG-36	**Los Alamos National Lab., NM (USA)**	
	6:24582	**LA–8830-MS**

• Report Number Index

Technical report literature is also indexed using report numbers. This index includes information on where individual reports may be obtained. Patents and conference papers are indexed here as a matter of convenience. When a report is supplied under an Order Number, that number is included in the availability statement. An Order Number–Report Number Correlation is included for convenience.

LA–		
8830-MS	**6:24582**	**NTIS, PC A05/MF A01. Order Number DE81023986, Distribution Category STD-20d**

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SUBJECT CONTENTS (NUMERICAL LISTING)

Six-digit subject category numbers are used in the storage, retrieval, and manipulation of bibliographic information entered into DOE's computerized bibliographic information system. The six-digit category numbers are utilized as if they were three pairs of two-digit numbers, the first two pairs being used to arrange the abstract content of *Energy Research Abstracts*. The following listing includes the totality of the 40 first-level and 293 second-level subject categories used. Because each issue of *ERA* announces only those documents becoming available during a semimonthly period, some subject categories may not be represented in every issue. The complete subject category scheme with scope definitions and limitations is available as DOE/TIC-4584-R5 from NTIS for $9.50.

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Six-digit subject category numbers are used in the storage, retrieval, and manipulation of bibliographic information entered into DOE's computerized bibliographic information system. The six-digit category numbers are utilized as if they were three pairs of two-digit numbers, the first two pairs being used to arrange the abstract content of *Energy Research Abstracts*. The following listing includes the totality of the 40 first-level and 293 second-level subject categories used. Because each issue of *ERA* announces only those documents becoming available during a semimonthly period, some subject categories may not be represented in every issue. The complete subject category scheme with scope definitions and limitations is available as DOE/TIC-4584-R5 from NTIS for $9.50.

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ENERGY RESEARCH ABSTRACTS

01 COAL AND COAL PRODUCTS

REFER ALSO TO CITATION(S) 7182, 7183

7081 (ACIRL-PR—82-12) Growth of Australian Coal Industries Research Laboratories Ltd., 1945 to 1982. Pollard, F. (Australian Coal Industry Research Labs. Ltd., North Ryde). Dec 1982. 25p. Australian Coal Industries Research Labs. Ltd., North Ryde.

The growth of ACIRL from the establishment of Coal Research Pty Ltd., in 1945 and Northern Colliery Proprietors Association Laboratory in 1946 to their amalgamation in 1956 to form Australia Coal Association (Research) Ltd., and then its incorporation in 1965 to form ACIRL is described. The structure and work of ACIRL is briefly discussed.

7082 (DOE/FE/60181—26) Low-rank coal research under the UND/DOE cooperative agreement. Quarterly technical progress report, July-September 1983. Wiltsee, G.A. Jr. (North Dakota Univ., Grand Forks (USA). Energy Research Center). 1983. Contract FC21-83FE60181. 238p. NTIS, PC A11/MF A01. Order Number DE84002700.

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Two long gasification tests were accomplished (66 and 72 hours of slagging operation) this quarter, and the balance of the wastewater needed for the second cooling tower (CT) test (~ 11,000 gallons) was generated. Eleven thousand gallons of slagging fixed-bed gasifier (SFBG) wastewater were solvent extracted and ammonia stripped (AS) to nominal levels of 160 mg/1 phenol and 600 mg/1 NH_3. This wastewater is being further treated by activated sludge (AS) and granular activated carbon (GAC) processing to prepare a high quality makeup for the second CT test. Phenol mass balances indicated that > 90 pct of the phenol was stripped from the tower, indicating that previous assumptions of high levels of biodegradation were erroneous. Over 80 pct of the ammonia and about 25 pct of the methanol were also stripped. Data collected during steady state operation of the bench-scale rotating biological contractor indicate complete removal of phenolics and alcohols, and 94 pct removal of BOD. Nitrification also occurred in this unit, with over 30 pct removal of ammonia. Problems due to individual bacteria, present in the biotreated wastewater, passing through the multi-media filter and thus decreasing the carbon adsorption efficiency of the GAC system, have resulted in lower treatment rates than originally anticipated. As a result, to achieve the desired treatment, the contact time of the wastewater with the carbon in the granular activated carbon system has been increased. Since this has decreased the treatment rate, a larger carbon adsorption system has been designed and is presently being constructed.

7083 (DOE/METC—83-60) Advances in fossil energy. (USDOE Morgantown Energy Technology Center, WV). [nd]. 55p. NTIS, PC A04/MF A01. Order Number DE84003378.

The Morgantown Technology Center is a US Department of Energy fossil fuel research center. It is reponsible for conducting research and development to extract, convert, and utilize coal, oil, and gas in an environmentally acceptable manner. METC performs and supports high-risk, high-payoff research and development, research that the private sector will not perform because of the risk and long-term payback aspects. In doing so, METC is developing a scientific and engineering knowledge base that can be used by the private sector to evaluate the technical and economic potential of the technologies investigated. METC made great strides in data base development in FY 1982. There are currently three major data bases in the development and implementation stages at METC: gasification, fluidized-bed combustion, and unconventional gas recovery. For each of these data bases, data are collected from METC-sponsored research activities and stored in a computerized data retrieval system. These systems are designed to make data from METC research readily accessible, so that METC can fulfill its technology transfer mandate. Another significant event at METC during FY 1982 was the installation of the Advanced System for Process Engineering (ASPEN) into the METC computer system. This powerful software package, developed by the Massachusetts Institute of Technology, is the first simulator capable of fully analyzing coal conversion processes. To date, METC has used ASPEN for simulating gasification, fluidized-bed combustion, and gas stream cleanup systems. METC was also selected by the ASPEN Industrial User's Group to be custodian of the public version of ASPEN at the National Energy Software Center.

7084 (ORNL—6008) Fossil Energy Program. Quarterly progress report for the period ending September 30, 1983. (Oak Ridge National Lab., TN (USA)). Nov 1983. Contract W-7405-ENG-26. 187p. NTIS, PC A09/MF A01. Order Number DE84004131.

This quarterly report covers the progress made during the period July 1 through September 30 for the Oak Ridge National Laboratory research and development projects that are carried out in support of the increased utilization of coal and other fossil fuels as sources of clean energy. These projects are supported by various parts of DOE including Fossil Energy, Basic Energy Sciences, Offices of Health and Environmental Research, Office of Environmental Compliance and Overview, the Electric Power Research Institute, and by the Tennessee Valley Authority and the EPA Office of Research and Development through inter-agency agreement with DOE.

0104 Processing

REFER ALSO TO CITATION(S) 7127, 7130, 7135, 7142, 7177, 7243, 7827, 7918, 8205

7085 (ACIRL-PR—83-3) Hydroliquefaction of Australian coals: the commissioning of a semi-continuous reactor. (Australian Coal Industry Research Labs. Ltd., North Ryde). Mar 1983. 26p. Australian Coal Industry Research Labs., Ltd., North Ryde.

A newly developed batch hydroliquefaction process, using a semi-continuous reactor is described. The aim of the development was to study the influence of process variables and coal preparation on yield, oil characteristics and solvent balance prior to conducting studies on continuous hydroliquefaction processes. (18 refs.)

7086 (ACIRL-PR—83-4) Effects of carbonization process variables on the coking properties of Australian coals. Burke, L.O.; Roberts, O.C. (Australian Coal Industry Research Labs. Ltd., North Ryde). Mar 1983. 30p. Australian Coal Industry Research Labs., Ltd., North Ryde.

Australian medium to low-volatile high-inertinite coking coals from the southern N.S.W. coalfield are known locally to be capable of producing hard dense metallurgical coke. However, this has not been appreciated by some overseas coke makers: the present investigation was undertaken to confirm this point and to study the behaviour of blends containing this rank and type of coal.

7087 **(CONF-830308—13) Effects of the preparative procedure on the reactivity of lignite chars.** Zabransky, R.F.; Nandi, S.P. (Institute of Gas Technology, Chicago, IL (USA)). 1983. 39p. Institute of Gas Technology, 3424 South State Street, IIT Center, Chicago, IL 60616.

From American Insititute of Chemical Engineers national meeting; Houston, TX, USA (27 Mar 1983).

The gasification characteristics of three lignites - Montana, North Dakota, and Darco - were studied in steam, hydrogen, and in an equimolar steam-hydrogen mixtures. For gasification in hydrogen, sodium has been shown to be more efficient as a catalyst than calcium. Comparative data on the reactivity of the chars prepared by devolatilization in nitrogen with a slow rate of heating (stabilized char) and by devolatilization in the reaction medium with a rapid rate of heating (in situ) indicated that there were three regimes - rapid-rate, transient-rate, and low-rate - for the gasification of the chars. The in situ chars were also more reactive than the stabilized chars. 5 references, 21 figures, 4 tables.

7088 **(CONF-830759—3) Corrosion studies in coal liquefaction plants.** Keiser, J.R.; Olsen, A.R. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 22p. NTIS, PC A02/MF A01. Order Number DE84003262.

From 16. annual technical meeting of the International Metallographic Society; Calgary, Canada (25 Jul 1983).

During the past few years, four direct coal liquefaction pilot plants have been operated in the United States in order to evaluate several liquefaction processes. Oak Ridge National Laboratory has provided assistance to pilot plant operators in assessing materials performance through supply and examination of corrosion samples, on-site examination of equipment, and analysis of failed pilot plant components in our laboratory. This paper describes these examinations which have revealed chloride and polythionic acid stress corrosion cracking, water-side pitting, sulfidation, and a chloride-related acid attack. The results of these analyses have helped identify corrosion problems and make proper material selections or design changes, and the results have provided designers of demonstration and commercial plants with information useful in selecting materials for the proposed plants.

7089 **(CONF-831166—1) Versatility of the U-GAS process: a French perspective.** Palat, P.; Schora, F.C.; Patel, J.G. (GDC, Inc., Chicago, IL (USA); Charbonnages de France-Chimie, Paris-Defense, 92 - Courbevoie; Institute of Gas Technology, Chicago, IL (USA)). 1983. 21p. GDC, Inc., 10 W. 35th St., Chicago, IL 60616.

From 3. worldwide synfuels symposium; Washington, DC, USA (1 Nov 1983).

In June 1983, the U-GAS process was selected by Charbonnages de France (CdF), the French national coal company, as its future commercial coal gasification technology. After evaluating most of the coal gasification processes, CdF selected the fluidized-bed technique as being most versatile and applicable to a wide variety of coals, including the high-ash-containing French coals. Actual testing of French coal was performed under CdF observation in pilot plant gasifiers that represent the world's most promising technologies. Following these tests, CdF chose the U-GAS technology. The Institute of Gas Technology (IGT) has developed the U-GAS process to produce gas from coal in an efficient, economic, and environmentally acceptable manner. The process represents the fruition of research and development in progress at IGT since 1974. The product gas from the process will be low-Btu gas usable as a fuel when operating with air, and will be medium-Btu or synthesis gas when operating with oxygen. The medium-Btu or synthesis gas can be used directly as a fuel, can be converted to substitute natural gas, or can be used for production of chemical products such as ammonia, methanol, hydrogen and oxo-chemicals. It can also be used to produce electricity generated by combined cycle or fuel cells. This paper discusses the U-GAS process, describes the results of recent pilot plant tests with a French coal, and outlines CdF's coal gasification project. 2 references, 9 figures, 2 tables.

7090 **(CONF-831239—2) ASPEN modeling of the Tri-State indirect liquefaction process.** Begovich, J.M.; Clinton, J.H.; Johnson, P.J.; Barker, R.E. (Oak Ridge National Lab., TN (USA); International Minerals and Chemicals, Terre Haute, IN (USA)). 1983. Contract W-7405-ENG-26. 12p. NTIS, PC A02/MF A01. Order Number DE84004437.

From Systems simulation symposium of fossil fuel conversion processes; Morgantown, WV, USA (6 Dec 1983).

The ASPEN process simulator has been used to model an indirect liquefaction flowsheet patterned after that of the Tri-State project. This flowsheet uses Lurgi moving-bed gasification with synthesis gas conversion to methanol followed by further processing to gasoline using the Mobil MTG process. Models developed in this study include the following: Lurgi gasifier, Texaco gasifier, synthesis gas cooling, Rectisol, methanol synthesis, methanol-to-gasoline, CO-shift, methanation, and naphtha hydrotreating. These models have been successfully developed in modular form so that they can be used to simulate a number of different flowsheets or process alternatives. Simulations of the Tri-State flowsheet have been made using two different coal feed rates and two types of feed coal. The overall simulation model was adjusted to match the Tri-State flowsheet values for methanol, LPG, isobutane, and gasoline. As a result of this adjustment, the MTG reactor yield structure necessary to match the flowsheet product rates was determined. The models were exercised at different flow rates and were unaffected by such changes, demonstrating their range of operability. The use of Illinois No. 6 coal, with its lower ash content, resulted in slightly higher production rates for each of the products as compared to use of the Kentucky coal.

7091 **(CONF-840201—1) Analysis of flushing injection performance in a reciprocating plunger slurry pump.** (Exxon Research and Engineering Co., Baytown, TX (USA). Baytown Research and Development Div.). 1984. Contract FC05-77ET10069. 27p. NTIS, PC A03/MF A01. Order Number DE84001649.

From ASME energy sources technology conference and exhibition; New Orleans, LA, USA (12 Feb 1984).

One of the major machinery problems encountered during operation of the Exxon Coal Liquefaction Pilot Plant was the relatively short life of the packing in the coal slurry reciprocating plunger pump. The cause of the short packing life was wear created by coal particles. Flushing oil was injected in the throat bushing on a portion of the plunger stroke to limit coal intrusion. To understand the effect of flush oil injection and the effect of the various pump design parameters on the flushing system, a mathematical model was developed by which the fluid dynamics of the throat bushing/plunger annulus could be analyzed. The transient equations of motion were solved numerically to yield the fluid velocity profile and the path of a given coal particle. The pressure gradient was evaluated iteratively from the imposed net flow rate condition which accounted for the flushing and leakage flow rates. Utilizing the model, a comparison was made between suction synchronized flushing and discharge synchronized flushing for various assumed leakage rates. The analysis showed that suction synchronized flushing was superior to discharge synchronized flushing. When the model was applied to ECLP's slurry pumps, it was found that for the pump with a throat bushing clearance length of 2.5 inches, the solids would enter the packing for practically any leakage rate. This was in good agreement with ECLP field experience. For the pump with a throat bushing clearance length of eight inches, the analysis indicated that at leakage rates as high as five gallons per hour solids would still not have entered the packing area. This was also in good agreement with ECLP field experience. Thus, it seems that the analytical model can be used in evaluating various design parameters as well as serving as a design tool for full scale slurry pumps.

7092 **(CONF-8308151—1) Acoustic instrumentation.** Raptis, A.C. (Argonne National Lab., IL (USA)). 1983. Contract W-31-109-ENG-38. 40p. NTIS, PC A03/MF A01. Order Number DE84003688.

From Coal combustion application working group meeting (CCAWG); La Jolla, CA, USA (24 Aug 1983).

This paper presents some of the work on acoustic instrumentation at ANL. It includes a basic description of the general acous-

tic system, some laboratory experiments, and operating and experimental information from experiments on prototype instruments installed in pilot plants. The findings of some initial theoretical feasibility studies were based on limited theoretical and experimental work found in the literature. These studies also indicated that acoustic/ultrasonic flowmeters were feasible for instrument operating frequencies below 500 kHz, and the frequency selected should be dependent on the size of the pipe. Laboratory and pilot-plant experiments were performed to supplement and verify the initial theoretical findings. These measurements also indicated that transducer availability was an important consideration, not only from the standpoint of high temperature serviceability, but also with regard to sensitivity of signal-level transmission and reception. Based on the theoretical studies and experimental results, a high-temperature acoustic Doppler flowmeter was developed. We review the results of testing of this Doppler flowmeter in the SRC-I, SRC-II, and H-Coal pilot plants. We also review other acoustic techniques and instruments including: (a) The active acoustic cross-correlation flowmeter developed during the HYGAS experiments and refined with tests in the laboratory. (b) The acoustic flow/no-flow monitor developed for the char return line of the BI-GAS pilot plant. This instrument was needed because char flow to the gasifier is essential for safe operation of the pilot plant. (c) The findings of feasibility studies for temperature and level measurements using acoustic/ultrasonic techniques.

7093 **(CONF-8311109—2) Measurement of solvent quality by electron spin resonance.** Mrochek, J.E.; Livingston, R.; Zeldes, H. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 36p. NTIS, PC A03/MF A01. Order Number DE84003284.

From Direct coal liquefaction contractor's review conference; Pittsburgh, PA, USA (16 Nov 1983).

Solvents from three coal liquefaction processes, Lummus Integrated Two-Stage Liquefaction (ITSL), H-Coal, and Wilsonville SRC-I, were analyzed by high-temperature, high-pressure, flow-through electron spin resonance (ESR) spectroscopy. Relative radical concentrations (product of the double integral of the derivative spectrum and the absolute temperature) were measured over a temperature range of ambient to 473°C. System pressure was maintained at 10.4 MPa for all except ambient-temperature runs, which were performed at atmospheric pressure. A comparison of solvents from the same process derived from the same coal indicated that those designated, by means of kinetic microautoclave analysis, as having higher quality generally had the lowest relative radical concentrations. Operating data compiled by International Coal Refining Company personnel for the Wilsonville Pilot Plant raised questions concerning the advisability of comparing ESR or any other potential measurement of solvent quality (SQ) with SQ values determined by microautoclave analysis utilizing a standard coal different from that from which the solvent was derived.

7094 **(DOE/ET/10069—T78) EDS coal liquefaction process development, Phase V. Monthly technical progress report, October 1-31, 1983.** (Exxon Research and Engineering Co., Florham Park, NJ (USA)). Nov 1983. Contract FC05-77ET10069. 16p. (FE—2893-124). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84004669.

Highlights from this report are summarized as follows: (1) Efforts to evaluate the requirements of the flushing and blowdown systems for commercial EDS plant designs are nearing completion. The major recommendations resulting from this study are summarized. (2) Environmental analyses performed under the Hybrid Boiler Development Program indicate that with combustion of EDS bottoms NO/sub x/ emissions are somewhat lower than for a high volatile bituminous coal. Trace organics and metals emissions and solid wastes are comparable to coal, and meeting existing and anticipated federal guidelines/regulations.

7095 **(DOE/ET/10532—T14) Refining and upgrading of synfuels from coal and oil shales by advanced catalytic processes. Quarterly report, April-June 1983.** Sullivan, R.F. (Chevron Research Co., Richmond, CA (USA)). Sep 1983. Contract AC22-76ET10532. 37p. (FE—2315-92). NTIS, PC A03/MF A01. Order Number DE84001650.

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Distillation work for Task 11 (distillation of H-Coal oil for Battelle Northwest Laboratories) is complete. Some additional analytical information is presented. In Task 12, product from the Integrated Two-Stage Liquefaction (ITSL) Process is being upgraded in a single step to product that is essentially heteroatom-free, using Chevron's ICR 106 catalyst. A pilot plant test has been onstream for over 3500 hours at several severities. The catalyst has shown excellent activity and stability. Detailed product properties are given in this report.

7096 **(DOE/ET/14705—1506) BI-GAS Illinois coal gasification program. Final technical report, September 1982-September 1983.** (Stearns-Roger, Inc., Denver, CO (USA)). 1983. Contract AC21-80ET14705. 212p. NTIS, PC A10/MF A01. Order Number DE84003100.

The primary purpose of this report is to cover in detail activities at the BI-GAS Coal Gasification Pilot Plant from September 1982 through September 1983. Due to lack of funds for further testing, the facility underwent deactivation, or mothballing, procedures from September through November of 1982. In January of 1983, the decision was made to reactivate the plant and operate with Illinois No. 6 Seam coal. Four gasifier test runs were conducted from May through September. The main achievements of this test series were to demonstrate operation with a char inventory while feeding a caking coal as well as to collect heat and material balance data. The results, conclusions and recommendations from these tests are discussed at length in the report. In addition, background information on the BI-GAS process, pilot plant facilities and operations history has been included. The individual test reports as well as a summary of the deactivation procedures, plus a subcontractor report and a study on conversion of the BI-GAS gasifier to single-stage operation, are supplied as appendices. 12 figures, 8 tables.

7097 **(DOE/ET/14803—T8) Coal liquefaction catalyst development. Final report, September 29, 1979-September 30, 1981.** Mahoney, J.A.; Helstrom, J.J.; Pellet, R.J. (Amoco Oil Co., Naperville, IL (USA). Research and Development Dept.). Aug 1982. Contract AC22-79ET14803. 298p. NTIS, PC A13/MF A01. Order Number DE83008148.

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This report discusses the results of work aimed at developing new catalysts for the H-Coal liquefaction process. The scope of the work extended over all the five task areas. Testing of several new catalyst formulations was completed. Promising candidates were found in the areas of stabilized aluminas and novel catalyst systems. These formulations were tested in the continuous aging unit. The addition of chromia to AMOCAT 1A (CoMo on bimodal alumina) was found to improve overall activity. Catalysts in the form of 1/8 in. extrudates were found to deactivate slower than 1/16 in. or 1/32 in. extrudates. Various batches of SRC-II heavy distillate were found to have markedly different abilities to act as donor solvents. Molten $SnCl_2$ was shown to be an effective catalyst promoter in a 6-day continuous aging unit run. Molten $SnCl_2$ supported on bimodal alumina also was an extremely active coal liquefaction catalyst. The HRI acid treating regeneration technique increased average micropore diameter of spent HDS-1442A to the same range as AMOCAT 1A and the catalyst behaved similarly in continuous aging studies. The feasibility of using the Amoco continuous aging reactor for screening SRC-I upgrading catalysts was demonstrated and AMOCAT 1C (Ni-Mo on bimodal alumina) was found to have the highest upgrading activity. A technique to measure MoS_2 dispersion was developed. This type of dispersion was found to play a key role in catalyst deactivation.

7098 **(DOE/ET/14928—1516) Experimental evaluation of the steady state and dynamic performance characteristics of the interactive units of a coal gasification process. Quarterly report, 29 March 1982-27 June 1982.** (General Electric Co., Schenectady, NY (USA). Corporate Research and Development Dept.). Jul 1982. Contract AC21-80ET14928. 34p. NTIS, PC A03/MF A01. Order Number DE84003967.

The test plan for the 1982 operating period has now been developed into an Operational Plan. This document identifies in detail the exact procedures to be followed, and the measurements to be

made by the system operators and the engineers to ensure that the objectives of each planned test will be met. The bench-scale activities related to the development of the ammonia stripping concept have been completed, and the results have been reported. It has been shown that the concept for stripping is technically feasible, and design data for possible pilot-scale demonstration have been generated. The 1982 test series included an assessment of the ability of the gasifier to destroy ammonia; this is the remaining aspect of the proof of this concept for reduction of NO/sub x/ emissions. All system modification and updates are complete, and several checkout runs have been made. This has enabled final training of the operational personnel to occur under realistic test conditions. This included extended operation and entire system startup and shutdown. All minor instrumentation problems revealed in this shakedown have been resolved. The entire Process Evaluation Facility (PEF) digital simulation system model has been completed, including the addition of controllers and enhanced time lag representations. The model has been used to evaluate system controllers settings, and, as a result, several improvements have been recommended. Also, the model has been transferred successfully to the PEF system data acquisition computer to aid in the validation of component models. 14 figures, 3 tables.

7099 **(DOE/ET/14928—1518) Experimental evaluation of the steady state and dynamic performance characteristics of the interactive units of a coal gasification process. Quarterly report, 28 September 1981-27 December 1981.** (General Electric Co., Schenectady, NY (USA). Corporate Research and Development Dept.). Jan 1982. Contract AC21-80ET14928. 85p. NTIS, PC A05/MF A01. Order Number DE84003968.

The Performance Evaluation Facility was operated in accordance with the established test plan. The 1981 operating period was completed in this quarter. The reduction of data taken during the 1981 facility operation was performed and prepared for publication. Cleanup system distributions of water, ammonia, phenols, and tars and oils have been compiled. The Benfield system sulfur removal and selectivity has been characterized over a range of operating conditions and inlet gas compositions. Gasifier performance characteristics, including heat and mass balances, have been assembled for six operating conditions. A bench-scale apparatus has been constructed for the investigation of air stripping of ammonia from the condensate stream. The condensing steam liquid heat exchanger model, and the air supply subsystem models complete the dynamic component models required for the system simulation. In addition, during this reporting period the pressure node calculation routine was developed and compared with unfired test data. Computerized mathematical models for the blast and fuel valve have also been developed during this reporting period. Integration of the combined cycle subcomponent models into a subsystem model has been completed. Upon completion of the 1981 Operational Test Program, sections of the PEF facility were disassembled for inspection and repair. The maintenance plan and schedule is being finalized in conjunction with the 1982 test plan definition. 14 figures, 3 tables.

7100 **(DOE/FE/05122—1485) Finding order in coal pyrolysis kinetics.** Solomon, P.R.; Hamblen, D.G. (Advanced Fuel Research, Inc., East Hartford, CT (USA)). Sep 1983. Contract AC21-81FE05122. 98p. NTIS, PC A05/MF A01. Order Number DE84000225.

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A number of experiments have suggested that the rate constants for the release of tar and for the thermal decomposition of the various functional groups in coal pyrolysis depend on the nature of the bridging bond or of the functional group, but appears relatively insensitive to coal rank for lignites, subbituminous and bituminous coals. The principal variation of pyrolysis behavior with rank is due to variations in the concentrations of functional groups and hence, the amount of each pyrolysis product. If the insensitivity of coal pyrolysis kinetics to coal rank can be generally demonstrated, it represents an important simplifying assumption in any general theory of coal pyrolysis. But the rank insensitivity of rate constants is controversial. There are two major questions. What species exhibit rank insensitive kinetics. Quantitatively, what does insensitivity mean, variations less than factors of two, ten, hundred, etc. This paper considers whether pyrolysis data in the literature support the hypothesis of rank insensitive kinetic rate constants. The experiments considered vary duration from 1.4 millisecond to 12 hours and in temperature from 350°C to 1800°C. Considering the available data, it appears that the decomposition of aliphatic and methyl functional groups, the loss of aromatic hydrogen and the evolution of tar and hydrocarbon species have rates which are relatively insensitive to rank variation. The rate varies by at most a factor of 5 between lignite and bituminous coals. Oxygen species are somewhat more rank sensitive. The factor of 5 variation in rate due to coal rank is substantially less than the factors of 100 to 10,000 in varition typical of reported rates. 56 references, 49 figures, 4 table.

7101 **(DOE/FE/55014—T6) Great Plains Gasification Associates. Quarterly technical and environmental report, third quarter, 1983.** (Great Plains Gasification Associates, Detroit, MI (USA)). 1983. Contract FM02-82FE55014. 135p. NTIS, PC A07/MF A01. Order Number DE84002370.

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Activities remain on schedule to meet GPGA's full gas production date. Home Office engineering for the Plant will be closed down early in the fourth quarter. The remaining engineering tasks will involve field support activities and special projects. A substantial amount of construction progress was achieved during the third quarter. Although the Plant's construction activities are still slightly behind schedule, it is currently forecasted that the construction schedule will be regained by the end of November, 1983. Start-Up operations are containing at a rapid pace. The current emphasis is on system turnover and commissioning activities. Almost all of the environmental permitting for the construction phase is complete. Mine development activities remain on schedule. In addition, initial coal deliveries to Basin Electric began in August. Construction of the Pipeline was completed this quarter.

7102 **(DOE/MC/14600—1427) Development of coal piston feeder. Phase I. Proof-of-concept.** Mistry, D.K. (Ingersoll-Rand Research, Inc., Princeton, NJ (USA)). Aug 1982. Contract AC21-80MC14600. 180p. NTIS, PC A09/MF A01. Order Number DE84002395.

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The piston feeder and test facility were upgraded to permit the testing of coals of various types, sizes and moisture levels to gas back pressure levels as high as 1000 psig. Bench scale testers were utilized extensively to evaluate improved seal and scraper components on an accelerated basis, and, to determine the flow characteristics of the various selected coals through the feeder. Performance testing was conducted on the pilot scale piston feeder to demonstrate satisfactory operation over its full range of operating parameters. These tests were made with the two (2) coal types found to exhibit the least desirable flow characteristics and maximum abrasivity, namely Montana and Pittsburgh sub-bituminous. A test matrix involving these coals sized to two (2) particle sizes (-1/8 in. and -1 in.) and two (2) moisture levels was performed. Operational data from these tests is contained in this report. The piston feeder successfully demonstrated operation to 1000 psig back pressure and a maximum throughput of 2.5 tons/hr at a specific horsepower level of 4 to 8.61 HP/TPH depending on back pressure level. Turndown, starvation and start/stop capabilities of the piston feeder were demonstrated. The feeder performed reliably, safely and with excellent control flexibility throughout the test program. 44 figures, 7 tables.

7103 **(DOE/MC/19299—12) Development of a pilot-scale kinetic extruder feeder system and test program. Phase II. Verification testing. Quarterly technical progress report, July-September 1983.** (Lockheed Missiles and Space Co., Inc., Sunnyvale, CA (USA). Energy Systems). 14 Oct 1983. Contract AC21-82MC19299. 27p. (LMSC-D—878374). NTIS, PC A03/MF A01. Order Number DE84002400.

This report covers the work carried out during the July-September 1983 quarter of the program. Endurance testing of the Kinetic Extruder Coal Feeder continued during the quarter bringing the total test time to 217 hours including over 100 start-stops. The feeder was operated at pressures up to 400 psig. The delivery rate was throttled from 0.6 tph to 2.25 tph. Repairs were required to the

drive system. High starting torque was observed during start-up after a week long shutdown. Disassembly revealed thermal breakdown of the grease in the bearing, and oil infiltration into the seal. Inspection of parts confirms low wear. Projected life expectancy of parts ranges from one year for the control nozzles to six years for the funnels. The equipment has been reassembled and testing will continue. 8 figures.

7104 **(DOE/MC/19403—1520) Development of a hot gas cleanup system for integrated coal gasification/molten carbonate fuel cell power plants. Quarterly report No. 4, July 1-September 30, 1983.** Anderson, G.L.; Berry, F.O.; Gross, M.N. (Institute of Gas Technology, Chicago, IL (USA)). Oct 1983. Contract AC21-82MC19403. 26p. NTIS, PC A03/MF A01. Order Number DE84004859.

The overall objectives of this program are to conduct: (1) laboratory-scale and bench-scale studies of a conceptual process using an air-regenerable mixture of metal oxide sorbents to remove sulfur-containing gases (such as hydrogen sulfide) from coal-derived fuel gas at 1200°F with subsequent direct production of elemental sulfur upon regeneration; (2) laboratory-scale studies of a process using molten-carbonate-containing porous ceramics to remove hydrochloric acid (HCl) and possibly heavy hydrocarbons and trace element-containing compounds from coal-derived fuel gas at 1200°F; and (3) an engineering and economic assessment of the above processes. Five metal oxides are being tested for their high-temperature sulfur removal characteristics in laboratory-scale studies. These are: (1) manganous oxide, MnO; (2) cobalt aluminate, $CoAl_2O_4$; (3) iron chromite, $FeCr_2O_4$; (4) iron orthosilicate, Fe_2SiO_4; and (5) cobalt titanate, Co_2TiO_4. The results of fixed-bed laboratory-scale studies with MnO^-, $CoAl_2O_4^-$ and $FeCr_2O_4$-containing sorbents have been previously reported. This quarter, fixed-bed studies with a United Catalyst, Inc., (UCI)-prepared Fe_2SiO_4 sorbent were completed. The fuel gas desulfurization characteristics of the UCI Fe_2SiO_4 sorbent remained stable from cycle to cycle. The elemental-sulfur-producing capabilities of the iron orthosilicate during regeneration were good initially but decreased with each cycle.

7105 **(DOE/NBM—4003400) Materials for coal conversion systems.** Bradley, R.A.; Judkins, R.R.; Hammond, J.P. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 31p. NTIS, PC A03/MF A01. Order Number DE84003400.

The materials performance data derived from laboratory and pilot plant testing provide much of the information necessary to select appropriate materials for construction of coal conversion plants. Sufficient information is available on materials for a prudent, possibly conservative, choice of materials for the various components of large demonstration or commercial plants. Some areas, such as letdown valve trim materials for coal liquefaction, refractories for slagging gasifiers, and heat exchangers for waste heat recovery in gasification systems, need significant improvement. However, other areas, such as improved pressure vessel steels or knowledge of the temperature effects on corrosion of various alloys in coal oils and coal gas atmospheres, need work to improve the economics, not the technological feasibility of the process. Maintenance of the current materials research and development efforts together with a more exhaustive study of the lessons learned from the pilot plants should lead to additional and more reliable guidance for the materials engineers involved in designing future plants.

7106 **(DOE/PC/50046—T1) Experimental unit comparisons: process yields. Report for the technical data analysis program.** (Pittsburg and Midway Coal Mining Co., Denver, CO (USA)). Dec 1983. Contract AC22-82PC50046. 88p. NTIS, PC A05/MF A01. Order Number DE84005032.

Yield and product quality data from SRC-II experimental research units were investigated to determine if differences existed among the various units. Yield differences among the bubble column units were found generally not to be statistically significant but statistically significant differences were observed between the bubble column units and a small continuous stirred tank reactor unit. Product quality data was very sketchy but did indicate that the PDU scale unit may have been producing higher product quality than the other units. Both yields and product qualities seemed to remain constant with time, in an extended run on the PDU unit supporting a conclusion that the process chemistry is stable in extended recycle operation. Based on cost of operation, data precision, flexibility of operation, and need to address specific design questions, it is recommended that most process development work for SRC and similar processes could be performed in a cost effective manner on highly instrumented bench-scale continuous units but that one or more large scale units will need to be operated to address certain critical equipment and process integration issues.

7107 **(DOE/PC/62255—T1) Analysis of user requirements and strategies for access/dissemination of the PETC LTDB.** (Orkand Corp., Silver Spring, MD (USA)). 27 Dec 1983. Contract AC22-83PC62255. 27p. NTIS, PC A03/MF A01. Order Number DE84004873.

A broad spectrum of prospective users of the PETC LTDB system exists. Five major user segments were identified as having the greatest degree of interest and need for coal liquefaction data. These user groups include: academic, state licensing agencies, A and E firms, the federal government, and producers of synthetic fuels. The data requirements of these users are considered to be primarily technical in nature, oriented toward the research and development aspects of past coal liquefaction projects; more specifically, the following priority subject areas: physical-chemical-thermodynamic properties of coal and coal liquids; design, construction, operation and performance of coal liquefaction facilities; environmental pollution aspects of coal products and by-products; and economic and cost analyses of past projects. These data are perceived as having multiple applications. There also remains the requirement for PETC to provide information assistance of a broader and more generalized nature with regard to synthetic fuels technologies. Additionally, there is a need to update the LTDB continually to include state-of-the-art developments in the field. Efforts to further interpret existing project data by PETC engineers are seen by most individuals in the user community as enhancing the value of the LTDB. However, primary interest among these users lies in the ability to access raw numeric data and original project documents for their own independent analysis. An essential concern of the user community is that the data made available to the public in the LTDB be subjected to stringent quality control standards and that a level of confidence be assigned in order to assess their accuracy.

7108 **(EUR—8382-EN) Chemical refining of coal (Report on ECSC contract 7220-EC/816).** (Commission of the European Communities, Luxembourg). 1983. 108p. Commission of the European Communities, Luxembourg.

Three areas of work were investigated: coal liquefaction with supercritical fluids; liquefaction by extraction with high boiling liquid solvents; and the production of resins from coal-derived hydrocarbons. (22 refs.)

7109 **(Juel-Spez—197) Methanation of synthesis gas with a cooled reactor.** Schiebahn, H.J.R.; Vorwerk, M.; Kiilerich-Hansen, H.; Skov, A.; Hoehlein, B.; Menzer, R. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorbauelemente). Mar 1983. 24p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750053.

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The methanation process is an important unit in generating synthetic natural gas (SNG) from coal and in providing heat in the "Long-Distance Nuclear Energy Transport" (NFE) system. Procedures for methanizing synthesis gases containing CO, CO_2 and H_2 have been developed and tested at the Kernforschungsanlage Juelich GmbH (KFA - Federal Republic of Germany) since 1976. This is being carried out together with our partner in the NFE Project, Rheinische Braunkohlenwerke AG, Cologne (FRG) and partly with Haldor Topsoe A/S in Copenhagen (Denmark). In 1982 a singlestage pilot plant was put into operation at the KFA in which one reactor with cooled "stepped" reaction tubes and catalytic fixed beds was utilized. The first test operation of 400 hours shows that at a high gas load on the reaction tubes, thermodynamic equilibrium at 320°C with a high methane content in the product gas can be achieved after about 5 m of the reactor length with simultaneous steam production at 100 bar.

7110 **(MLM-MU—83-71-0002) History of the H-Coal pilot plant component performance.** DeWitt, R. (Monsanto Research Corp., Miamisburg, OH (USA). Mound). Nov 1983. Contract AC04-76DP00053. 149p. NTIS, PC A07/MF A01. Order Number DE84004352.

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This report is a compilation of the critical component operating experience at the H-Coal liquefaction pilot plant at Catlettsburg, Kentucky. Monthly, quarterly, and annual reports, as well as topical reports were reviewed for information concerning pumps, valves, instrument and controls, materials and heater and heat exchanger. In addition, information from minutes of the Technical Advisory Committee (TAC) and the Management Advisory Committee (MAC) meetings and other special component performance meetings were studied. In addition to a component operational performance summaries, this report presents a history of significant operational events for each component which serves to trace component problems, proposed solutions and their effectiveness in time. It also serves as a locater of information that has appeared in the various pilot plant reports as well as provide as a fast overview of the history of each problem.

7111 **(MTR—83W42-Vol.2) Critical evaluation of solvent deashing of coal liquids. Volume II. Kerr-McGee Critical Solvent Deashing process.** ElSawy, A.; Gray, D.; Neuworth, M.B.; Tomlinson, G. (Mitre Corp., McLean, VA (USA). METREK Div.). Nov 1983. Contract AC01-80ET13300. 176p. NTIS, PC A09/MF A01. Order Number DE84004984.

This is the second part of a MITRE study on the comparative evaluation of two coal liquid solvent deashing processes - the Lummus Antisolvent Deashing (ASDA) process and the Kerr-McGee Critical Solvent Deashing (CSD) process. The first volume dealt with the Lummus ASDA process; this volume deals with the Kerr-McGee process and compares the two systems as methods for performing deashing in the Integrated Two Stage Liquefaction (ITSL) process. The Kerr-McGee process has evolved as an extended application of the Residual Oil Supercritical Extraction (ROSE) process originally developed by Kerr-McGee for recovering ash and asphaltene material from petroleum residuals. It has since been extensively developed as a process for deashing the solvent refined coal (SRC) product. The deashing requirements in the ITSL process are quite similar to those for the SRC process. The feeds requiring deashing are similar in that they are a coal extract slurry. This slurry consists of process solvent, coal dissolution products, unconverted coal and ash which have been produced primarily by thermal coal dissolution. In the ITSL process, it is desirable to remove ash and undissolved coal from this solution in order to improve the effectiveness of downstream catalytic hydrotreating. The Kerr-McGee CSD process is basically a critical solvent extraction process involving the selective extraction of coal liquefaction products (condensed nonvolatile or non-distillable substances such as SRC) using an organic solvent near its critical temperature and pressure. The feed to the K-M deashing system is the bottoms material from vacuum distillation of the products from the coal dissolution reactor.

7112 **(NP—3770156) Effect of water and air on the surface of brown coal high-temperature fine coke.** Dallmann, W. (Technische Hochschule Aachen (Germany, F.R.). Fakultaet fuer Bergbau und Huettenwesen). 23 Feb 1979. 107p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE83770156.

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This work attempts to quantitatively determine the procedures taking place during the cooling and ageing process of freshly degassed bulk won coal, brown coal high-temperature fine coke. The physisorption and the chemisorption, particularly of water and air on the coke surface are theoretically and practically investigated. The different cooling conditions on the brown coal high-temperature fine coke are evaluated based on the gained analysis results of the coke investigated.

7113 (NP—4770030, pp 663-678) **Theoretical studies on the underground gasification.** Krauss, U.; Marzilger, B. [nd]. (In German). NTIS (US Sales Only), PC A99/MF A01.

In Status report 1982. Geotechnics and deposits. Vol. 2.

Gasification efficiencies in the hydrogenating underground gasification were determined by a two-dimensional simulator. The limiting parameters which are undispensable for the self-sustaining of the hydrogenating underground gasification are indicated and other limiting parameters which are necessary for a sufficiently large borehole distance are given. In particular it could be proven that the natural gas permeability in the ungot seams has to be essentially improved in a greater depth in order to be able to apply the filtration process at borehole distances which are of interest for the practice.

7114 (NP—4770030, pp 679-690) **Behaviour of bituminous coals in the underground gasification in a temperature-pressure gradient.** Palz, K.; Schloemer, H.; Wagner, J. [nd]. (In German). NTIS (US Sales Only), PC A99/MF A01.

In Status report 1982. Geotechnics and deposits. Vol. 2.

Measurements on the volume and permeability behaviour of monolithic bituminous coal under elevated pT-in-situ conditions with different gases are presented. The process gases air and CO_2 lead partly to a considerable extension of the plastic range: on the contrary N_2 doesn't influence the plastic behaviour in the investigated pressure range. The Saar flame coal behaves with concern to its dilation as a function of the increase of the process gas pressure and the kind of process gas analogous to the plastic behaviour. The maxima of ultimate expansion coincide with the highest extension of the plastic range. Permeability measurements were carried out in the 'carbonization' and 'semi-coke and coke' range also.

7115 (NP—4770030, pp 691-708) **Pressure swing underground gasification.** Breiding, P.; Guntermann, K.; Kurth, M.; Ropertz, G. [nd]. (In German). NTIS (US Sales Only), PC A99/MF A01.

In Status report 1982. Geotechnics and deposits. Vol. 2.

It is reported about experimental investigations and model developments to produce substitute natural gas, reduction gas or other fuel gases by the coal gasification in deep deposits. Physical characteristics and kinetic data are determined in a small autoclave plant in pyrolysis and hydrogenating, air and steam gasification experiments. Further gasification experiments were carried out according to the filtration process and channel combustion. The channel gasification process, the reverse combustion and the block circulation process are investigated in a large autoclave plant under stationary pressure and pressure swing conditions. The experimental results are presented.

7116 (NP—4770030, pp 709-728) **Status of the Belgian-German experiment on the in-situ gasification of coal.** Ledent, P.; Beckervordersandforth, C.P.; Chandelle, V.; Fabry, R.; Li, T.K.; Sonntag, C. [nd]. (In German). NTIS (US Sales Only), PC A99/MF A01.

In Status report 1982. Geotechnics and deposits. Vol. 2.

It is reported about the Belgian-German joint project for the underground gasification in a coal deposit in a depth of 900 m by channel combustion tests and the following combustion of the developed coal at elevated pressures. The plant location in the Southbelgian coal district, the deposit, the drilling works, the well completion and the surface plant are described in detail. The total plant contains parts to carry out injection and communication tests with water and nitrogen, channel combustion and gasification experiments.

7117 **(ORNL/SGMP—83/2) Surface gasification materials program. Semiannual progress report for the period ending September 30, 1983.** Bradley, R.A. (Oak Ridge National Lab., TN (USA)). Nov 1983. Contract W-7405-ENG-26. 153p. NTIS PC A08/MF A01. Order Number DE84004133.

The objective of the Surface Gasification Materials Program is to conduct research and development on materials for application to the specific needs of coal gasification systems. One of the goals of the program is to evaluate innovative fabrication methods which have the potential to lower costs and improve reliability and safety for gasifier vessels and components. Another goal is to conduct engineering-scale development and application of materials for coal gasification systems to ensure that the materials of construction for

pilot plants and future large-scale plants can be properly selected and specified. Contents of this report are: (1) plant materials surveillance tests; (2) slagging gasifier refractories; (3) protective coatings and claddings; (4) ceramic fabrication/application technology; (5) ceramic application technology - brittle material design; (6) advanced pressure vessel materials technology; (7) electroslag component casting; (8) production and evaluation of electroslag castings; (9) cost reduction of the electroslag casting manufacturing process; (10) quantitative microstructural characterization of steel castings; (11) materials review and component failure analysis in support of coal gasification process and plants; and (12) process plant materials review, evaluation, and support.

7118 **(ORNL/TM—8775) Trace component analyses of H-Coal pilot plant wastewater subjected to polishing operations.** Brown, C.H. Jr.; Mrochek, J.E.; Dinsmore, S.R. (Oak Ridge National Lab., TN (USA)). Dec 1983. Contract W-7405-ENG-26. 33p. NTIS, PC A03/MF A01. Order Number DE84004123.

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The ORNL wastewater treatment process development unit was tested at the H-Coal pilot plant in Catlettsburg, Kentucky. It was used to treat the clarified effluent from the H-Coal activated sludge bioreactor. The processing sequence started with multimedia filtration, followed by ozonation, carbon adsorption, pH adjustment, and reverse osmosis (RO). Suites of samples from the influent and effluent of the ozonation, carbon adsorption, and RO modules were taken on two separate days, preserved, and returned to ORNL for trace-element analyses. The RO samples were analyzed for metal cation and the complementary anions. The organic analyses included the use of high performance liquid chromatography and gas chromatography to characterize certain components and their concentrations. Some limited molecular identifications were made using gas chromatography-mass spectrometry. Material balances based on the inorganic analyses suggest that barium and iron are precipitant-type foulants in the RO module. Analysis of the RO permeate by GC showed two minor components (as compared with four in the feed), which may be inorganic. Comparison of permeate quality with drinking water standards indicated that no component was present in anything near hazardous amounts, although mercury and arsenic were not analyzed. Data for cation rejection by the RO membrane indicated very high rejection for most cations. Organic analyses showed that the process development unit performed very efficiently. The carbon adsorption effluent was not distinguishable from distilled water by HPLC; however, the more sensitive GC detected several differences. Purgeable nonpolar organics were found by purge and trap analyses in the feed to the ozonation unit. The results complement those obtained during routine operation of the PDU at the H-Coal pilot plant.

7119 **(ORNL/TM—8777) Plan for radionuclide tracer studies of the residence time distribution in the Wilsonville dissolver and preheater.** Jolley, R.L.; Begovich, J.M.; Brashear, H.R.; Case, N.; Clark, T.G.; Emery, J.F.; Patton, B.D.; Rodgers, B.R.; Villiers-Fisher, J.F.; Watson, J.S. (Oak Ridge National Lab., TN (USA)). Dec 1983. Contract W-7405-ENG-26. 78p. NTIS, PC A05/MF A01. Order Number DE84004204.

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Stimulus-response measurements using radiotracers to measure residence time distribution (RTD) and hydrodynamic parameters for the preheaters and dissolvers at the Ft. Lewis Solvent Refined Coal (SRC) and the Exxon Donor Solvent (EDS) coal conversion pilot plants are reviewed. A plan is also presented for a series of radioactive tracer studies proposed for the Advanced Coal Liquefaction Facility at Wilsonville, Alabama, to measure the RTD for the preheater and dissolvers in the SRC-I mode. The tracer for the gas phase will be ^{133}Xe, and ^{198}Au (on carbonized resin or as an aqueous colloidal suspension) will be used as the slurry tracer. Four experimental phases are recommended for the RTD tracer studies: (1) preheater; (2) dissolver with 100% takeoff; (3) dissolver with 100% takeoff and solids withdrawal; and (4) dissolver with 50% takeoff. Eighteen gas-tracer and 22 liquid-tracer injections are projected to accomplish the four experimental phases. Two to four tracer injections are projected for preliminary tests to ensure the capability of safe injection of the radiotracers and the collection of statistically significant data. A complete projected cost and time schedule is provided, including procurement of necessary components, preparation of the radiotracers, assembly and testing of tracer injection apparatus and detection systems, onsite work and tracer injections, laboratory experimentation, data analysis, and report writing.

7120 **(ORNL/TM—8797) Assessment of critical materials requirements for a direct coal liquefaction facility.** Lennon, D.L.; Olsen, A.R. (Oak Ridge National Lab., TN (USA)). Nov 1983. Contract W-7405-ENG-26. 53p. NTIS, PC A04/MF A01. Order Number DE84004111.

An estimate of the materials requirements for a commercial-size [output equivalent to 8000 m^3/d (50,000 bbl/d) oil] direct coal liquefaction facility was based on engineering and technical data from a preliminary facility design, and the results were compared with other published data. Our assessment estimates significantly higher requirements for most materials. The comparison of the results of this study with U.S. domestic annual consumption shows that the requirements for Cr, Co, Mo, and Ni are significant relative to domestic annual consumption. For a 160,000-m^3/d (1,000,000-bbl/d) scenario for production of synthetic fuels from coal, annualized chromium and nickel requirements will be 5.4 and 6.2%, respectively, of 1981 domestic consumption, and by implication the requirements for cobalt and molybdenum would also be significant. This daily production is roughly equivalent to 7% of the national oil consumption in 1982 or 14% of the anticipated oil imports in 1990. Because the United States imports 97% of the Co, 92% of the Cr, and 77% of the Ni it uses, apparently the development of a significant synthetic coal liquids industry could impact the critical status of these three elements. Recommendations for additional similar assessments of materials requirements and improved methods of accomplishing them are presented.

7121 **(ORNL/TM—8908) Program plan for development of hot dirty gas compressors/expanders for coal gasification systems.** Lackey, M.E. (Oak Ridge National Lab., TN (USA)). Nov 1983. Contract W-7405-ENG-26. 34p. NTIS, PC A02/MF A01. Order Number DE84004163.

This effort was conducted to provide supporting data for a proposed Department of Energy program for the development of components for hot dirty gas service in gasification systems. This report deals with compressor/expander applications, and its scope includes a broad range of gasification systems such as the generic models for entrained-flow, moving-bed, and fluidized-bed gasifiers. The normal isostatic operation of gasification systems indicated that there is little incentive to use hot dirty gas compressors/expanders in the primary gasification streams. Gasification systems that require auxiliary carbon combustion to either supply heat or to use char will require a combustion unit that can accept a wide range of fuels. Some of these units can be effectively coupled to a hot dirty gas expander. A state-of-the-art industrial capabilities survey indicated that cat-cracker expander operating conditions closely approached those of a PFBC. The estimated life of these units is in the 3- to 6-year range at an inlet temperature of 705°C (1300°F) and 1/3- to 1-year range at an inlet temperature of 900°C (1650°F). A present effort to increase the service life of expanders at inlet temperatures of up to 900°C (1650°F) is sponsored by DOE as part of the PFBC development program. The scope of the present program to advance the state of the art of hot dirty gas expanders, coupled with industry capability of supplying the presently envisioned gasification needs, appears to be sufficient to fulfill anticipated gasifier needs. Therefore, no expansion of the research and development efforts of the hot dirty gas expander program is justified. However, the general work performed as part of the PFBC program involves test areas that could have direct applications to gasification components. The PFBC program should be closely monitored for potential technology transfer to gasification applications. 15 references, 8 figures, 5 tables.

7122 **Regeneratively cooled coal combustor/gasifier with integral dry ash removal.** Beaufrere, A.H. (to Dept. of Energy). US Patent 4,407,205. 4 Oct 1983. Filed date 30 Apr 1982. vp.

PAT-APPL-373582.

A coal combustor/gasifier is disclosed which produces a low or medium combustion gas for further combustion in modified oil or gas fired furnaces or boilers. Two concentric shells define a combustion volume within the inner shell and a plenum between them through which combustion air flows to provide regenerative cooling of the inner shell for dry ash operation. A fuel flow and a combustion air flow having opposed swirls are mixed and burned in a mixing-combustion portion of the combustion volume and the ash laden combustion products flow with a residual swirl into an ash separation region. The ash is cooled below the fusion temperature and is moved to the wall by centrifugal force where it is entrained in the cool wall boundary layer. The boundary layer is stabilized against ash re-entrainment as it is moved to an ash removal annulus by a flow of air from the plenum through slots in the inner shell, and by suction on an ash removal skimmer slot.

7123 **Pyrite decomposition in fresh Blacksville No. 2 coal: Effect of additives.** Bommannavar, A.; Montano, P.A. (Department of Physics, West Virginia University, Morgantown, WV 26505). *Fuel;* 62: No. 8, 932-935(Aug 1983).

The Mossbauer effect has been used to study the effect of additives (S, FeS_2, Fe_7S_8 and Fe) on the transformation of pyrite in fresh Blacksville No. 2 coal under liquefaction conditions. It was observed that the addition of iron sulphides enhanced the conversion of the inherent pyrite in coal, an effect attributed to a combined cracking activity of the pyrrhotites and H_2S on the less reactive organic covering of some of the inherent coal pyrite. The addition of sulphur produced a higher partial pressure of H_2S; total conversion of pyrite to pyrrhotite was not observed. The stoichiometry of the pyrrhotites present in the residue of the experiment with sulphur showed a smaller atomic percentage of iron than in the experiment without additives, this change in stoichiometry being attributed to the higher partial pressure of H_2S in the reactor. When metallic iron was added, the partial pressure of H_2S in the reactor decreased (iron acts as a scavenger) and troilite was also formed.

7124 **Measurement of slurry concentration and flow rates in shell and tube slurry heat exchangers.** Moujaes, S. (RTDD/International Coal Refining Company, Allentown, Pennsylvania). *Proceedings, Intersociety Energy Conversion Engineering Conference;* 1: 411-416(Aug 1983). (CONF-830812—).

From 18. intersociety energy conversion engineering conference; Orlando, FL, USA (21 Aug 1983).

A study has been conducted on slurry flow behavior in vertical tubes having diameters of one inch in an upflow mode. A tube sampling technique and an optical electronics method were developed to determine the slurry concentration and flow rates for slurries comprised of different size particles. These methods will be applied in cold flow simulation of a shell and tube slurry heat exchanger.

0105 By-products

REFER ALSO TO CITATION(S) 7333, 8526

0106 Properties

REFER ALSO TO CITATION(S) 7086, 7112, 7156, 7163, 7170

7125 **(ACIRL-PR—82-7) Development of a modified J.I.S. coke drum test procedure.** (Australian Coal Industry Research Labs. Ltd., North Ryde). Oct 1983. 13p. Australian Coal Industry Research Labs., Ltd., North Ryde.

A modified Japanese Industrial Standard (J.I.S.) drum test procedure has been developed. Sub-samples of different coals and blends were carbonized in 7 kg capacity coke ovens and in a moveable wall coke oven (capacity 280kg). The cokes produced in the 7 kg ovens were tested using a modified J.I.S. test procedure. The cokes produced in the moveable wall coke oven were tested using the standard J.I.S. test procedure. Good correlations between the modified drum index and the standard drum indices were found. (3 refs.)

7126 **(BCRA-CRR—101) Separation and characterization of nitrogen heterocyclic compounds present in coke-oven pitch.** (British Carbonization Research Association, Chesterfield). Dec 1982. 31p. British Carbonization Research Association, Chesterfield, England.

Investigations have been carried out in order to characterize the basic and non-basic polycyclic nitrogen compounds present in coke-oven pitch extracts. Basic compounds were extracted from the cyclohexane-soluble portion of pitch by acid washing with 10% H_2SO_4. Non-basic nitrogen heterocycles were subsequently concentrated by liquid chromatography on a column packed with the organo-clay Bentone 38. The fractions were then characterized by the application of reverse phase HPLC with spectrofluorimetric examination of the separated components. (13 refs.)

7127 **(BCRA-CRR—103) Comparison of the properties of cokes made in a laboratory furnace and in the BCRA 250-kg test oven, with a study of the effect of inerts on coke quality.** (British Carbonization Research Association, Chesterfield). Dec 1982. 21p. British Carbonization Research Association, Chesterfield, England.

Investigations were carried out to assess and compare coke made from the same coals in the travelling-tube furnace and in the BCRA 250 kg test oven. The travelling tube furnace was also used to study the influence of inerts on the strength of coke made from a wide range of coking coals. (3 refs.)

7128 **(CONF-831239—1) Analysis of coal liquids physical properties.** Khan, A.A.; Begovich, J.M.; Johnson, P.J. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 34p. NTIS, PC A03/MF A01. Order Number DE84004647.

From Systems simulation symposium of fossil fuel conversion processes; Morgantown, WV, USA (6 Dec 1983).

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Many coal conversion plant designs use physical property correlations that characterize a coal liquid by the cumulative weight boiling curve and specific gravities and molecular weights associated with that curve. Results of simulated material balances produced by using selected thermodynamic physical property correlations and ASPEN simulator are compared to pilot plant data. To conduct this study, a preprocessing program, COALIQ, was developed which produces an ASPEN input file given the characterization data for the coal liquid and the selected correlations. Under moderate pressures and temperatures, reasonable K-values are obtained for systems containing only hydrogen, methane, and coal liquid; however; overall deviations are more pronounced near critical conditions. Because of the scatter of data for the cases examined, deviations caused by the use of different thermodynamic physical property correlations were not noticeable. Although the overall predicted mass balance for the P-99 pilot plant flash unit was close to the data, large deviations were noticed in individual component balances, particularly for water and the heavy coal liquid cuts. While the quality of pilot plant data may be questioned, equations of state that can accurately handle water-hydrocarbon mixtures and equations of state which behave robustly near the critical region should be included in ASPEN. 8 references, 2 figures, 5 tables.

7129 **(DOE/PC/40789—T8) Thermal and radiative properties of coal ash deposits. Technical progress report No. 8, September 1, 1983-November 30, 1983.** Anderson, D.W.; Vader, D.T.; Zumbrunnen, D.A.; Incropera, F.P.; Viskanta, R. (Purdue Univ., Lafayette, IN (USA). School of Mechanical Engineering). 1983. Contract FG22-81PC40789. 15p. NTIS, PC A02/MF A01. Order Number DE84004983.

In the last quarter, three successful experiments on coal-ash deposits have been completed in the High Temperature Test Facility. In each experiment, a layer of ash particles of uniform thickness was studied. Results of two of these experiments are discussed. Data from the third experiment is being reduced at the time of this report.

7130 **(ESG-DOE—13419) Molten salt interactions in coal processing. Final technical report.** Dunks, G.B.; Stelman, D. (Rockwell International Corp., Canoga Park, CA (USA). Energy Systems Group). 30 Dec 1983. Contract AT03-76ER70030. 129p. NTIS, PC A07/MF A01. Order Number DE84004745.

The oxidation of spectroscopic-grade graphite in sodium carbonate, sodium carbonate/sodium sulfate mixtures, and sodium chloride melts using oxidizing (air, oxygen, and carbon dioxide) or inert (argon and nitrogen) sparge was investigated between 900 and 1050°C. The oxidation rate increased with increasing graphite surface area, increasing melt temperature, and increasing oxygen concentration. The rate, at 900°C using air sparge, was faster in pure sodium carbonate than in pure sodium sulfate with the maximum rate observed in mixed melts. At 950°C, the oxidation rate was virtually equal in the two pure melts; at >982°C, the rate was faster in pure sodium sulfate. In melts containing sodium sulfate, the rate-determining step was apparently the same for reactions conducted in oxidizing and inert atmospheres, with sodium sulfate acting as a catalyst in the former and a reagent in the latter. The overall oxidation rate using air sparge in sodium chloride melt was the slowest of the melts studied; however, the oxygen and temperature dependences suggested that the rate-limiting step was the same as in sodium carbonate melt. Electrochemical evidence for the formation of metallic sodium suggested that a first step in the oxidation process was the reduction of sodium ion by graphite. The positive centers thus generated in the graphite matrix apparently reacted with oxyanions in the melt to produce carbon monoxide and/or carbon dioxide. The oxidation rate of a graphite electrode using carbon dioxide-containing sparge gas was increased by applying positive potentials and decreased by applying negative potentials, which supports such an ionic mechanism. The initial rates of graphite oxidation using nitrogen or carbon dioxide sparge were approximately equal and were 6.5 times slower than the rate using air in sodium carbonate melt. 51 figures, 9 tables.

7131 **(MIRL—64) Petrology of cretaceous coals from northern Alaska. Final technical report, September 1, 1981-February 28, 1983.** Rao, P.D.; Smith, J.E. (Alaska Univ., Fairbanks (USA). Mineral Industry Research Lab.). 15 Mar 1983. Contract FG22-80PC30237. 153p. NTIS, PC A08/MF A01. Order Number DE84003700.

Alaska has large coal resources and a major portion of these lie on the Arctic North Slope. A project was initiated with the support of the US Department of Energy to conduct a reconnaissance petrological survey of the Northern Alaska field, in order to get a better idea of the potential for liquefaction of the coals. Approximately 300 samples of coals were collected from surface outcrops, diamond drill holes, auger holes, seismic shot holes and oil exploration test wells, from a 10,000 square mile area. A comparison of vitrinite reflectance with other analytical data showed that outcrop samples, auger hole samples and seismic shot hole samples from a depth less than 40 feet are oxidized, and vitrinite reflectance would be better criterion for rank determination than the other parameters. Coals from Tunalik test well gave a satisfactory correlation of moist, mineral-matter-free heating value with depth, whereas reflectance values showed wide scatter. The macerals counted for quantitative petrology were ulminite/vitrinite, pseudovitrinite, gelinite, phlobaphinite, pseudophlobaphinite, sporinite, resinite, cutinite, alginite, exsudatinite, thick cutinite, suberinite, other liptinites (including liptodetrinite) fusinite, semifusinite, macrinite, globular macrinite, inertodetrinite and sclerotinite. Trend surface analysis showed that coals with the highest reflectance, lowest inertinite and highest liptinite lie in the foothills region. Some samples in the Cape Beaufort region had inertinite concentrations up to 50%. Reflectance and microhardness data are presented for various macerals for the twelve representative coals from the study area. 24 references, 41 figures, 51 tables.

7132 **Electron spin resonance studies of some Canadian coals.** Khulbe, K.C.; Chan, B.W.; MacPhee, J.A.; Mann, R.S.; Manoogian, A. (Department of Chemical Engineering and Department of Physics, University of Ottawa, Ontario K1N 9B4). *Fuel;* 62: No. 8, 973-974(Aug 1983).

Nine Canadian coals of different rank and composition were studied by electron spin resonance. For percentage of fixed carbon in the range of 43 to 78 wt%, the free radical g values were found to increase with decreasing carbon content, and did not level off for the low rank coals. The free radical line widths are attributed to atomic species such as oxygen and not to protons of hydrogen.

0108 Waste Management

REFER ALSO TO CITATION(S) 7082, 7118, 7141, 7161, 8547

7133 **(ACIRL-PR—82-6) Corona apparatus for improved electrostatic precipitation evaluation of fly ash.** (Australian Coal Industry Research Labs. Ltd., North Ryde). Oct 1982. 56p. Australian Coal Industry Research Labs., Ltd., North Ryde.

The development of a laboratory corona apparatus which could produce repeatable corona characteristics from small samples of fly ash is described. The corona characteristics obtained from the apparatus were able to correctly rank fly ashes in terms of collection efficiencies in a pilot plant electrostatic precipitator. The results can also be used to diagnose electrostatic precipitator difficulties at power stations. (19 refs.)

7134 **(ACIRL-PR—83-1) Coal preparation: plant rejects disposal planning guidelines.** Stockton, N.D.; Graham, C.C. (Australian Coal Industry Research Labs. Ltd., Sydney). 1983. 28p. Australian Coal Industry Research Labs., Inc., Sydney.

This document aims primarily to assist colliery management and does not attempt to detail the many methods of reject disposal appropriate to specific site difficulties. These guidelines recommend early consultation with government authorities in the planning of reject disposal operations. The involvement of coal preparation and engineering expertise during the planning sequence is also recommended.

7135 **(BCRA-CRR—105) Further studies on the role of inhibitors in the biological treatment of carbonization wastes: improved removal; development of chromatographic analysis and biological assay; and preliminary isolation and characterization.** (British Carbonization Research Association, Chesterfield). Dec 1982. 43p. British Carbonization Research Association, Chesterfield, England.

Chemical precipitation was investigated as a possible alternative method to adsorption for the removal of inhibiting material from coke-oven wastes. The effect of such pretreatment on biochemical oxidation by activated sludge was studied in conjunction with the development of improved techniques for chromatographic analysis. Preliminary work on the isolation and characterization of inhibitory components was carried out. The development of a biological inhibition assay was commenced. (2 refs.)

7136 **(CONF-831112—2) Evaluation of a spray dryer flue gas leaning system on high sulfur coal.** Farber, P.S.; Livengood, C.D.; Huang, H.S.; Ishak Bin Thani, M.; Koch, B.J.; McCoy, D.C.; Statnick, R.M. (Argonne National Lab., IL (USA)). 1983. Contract W-31-109-ENG-38. 19p. NTIS, PC A02/MF A01. Order Number DE84004032.

From Coal technology '83 - international coal utilization convention; Houston, TX, USA (15 Nov 1983).

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In April 1983, Argonne National Laboratory (ANL), Consolidation Coal Company (Consol) and Conoco Coal Research Division successfully demonstrated that sulfur dioxide (SO_2) emission from a high-sulfur (4.2%) coal could be controlled to the 1979 New Source Performance Standards (NSPS) requirements (90% SO_2 reduction) using a lime based spray dryer system. Based on these test results, the spray dryer FGD technology appears economically viable for high-sulfur coal, NSPS applications. The relative simplicity of the spray dryer process vis-a-vis wet lime/limestone FGD systems has made it a favorite among western utilities for lower sulfur coals. The Argonne test is further proof that the spray dryer process can be technically and economically extended to higher sulfur coal applications, thus giving utilities another scrubbing option to consider for installations where current environmental laws dictate lower SO_2 emissions. As a result of our test, several

minor modifications to the Argonne spray dryer process and to the operating procedures were implemented. These modifications have improved the reliability of the spray dryer system. 5 references, 6 figures, 6 tables.

7137 **(DOE/ET/15492—T44) Laboratory/bench scale testing and evaluation of A.P.T. dry plate scrubber. Fifteenth quarterly progress report, September 1, 1983-November 30, 1983.** (Air Pollution Technology, Inc., San Diego, CA (USA)). 18 Nov 1983. Contract AC21-80ET15492. 15p. NTIS, PC A02/MF A01. Order Number DE84004401.

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The objective of this project is to conduct a bench scale experimental evaluation of the dry plate scrubber (DPS) at high temperature and pressure to determine its potential for controlling particulate and alkali vapor emissions from PFBC processes. The major technical objectives for this quarter were to complete particle removal experiments at 850°C and 10 atmosphere, and start work on prevention of ash cake accumulation. During the reporting period, the damaged main air heater and its controller were repaired by replacing the heating element of the heater and the main circuit board in the controller. Also, the pipe for diverting a side stream of flue gas from the A.P.T. AFBC to the Task 8 apparatus was installed and an operation permit for the AFBC was filed with the San Diego Air Pollution Control District. Two filter holders and a double pipe heat exchanger of the experimental apparatus were designed and the heat exchanger was built. 5 figures. (DMC)

7138 **(DOE/PC/60418—T1) Feasibility of a hot coal ash impact separator. Quarterly project status report No. 1, September 1-November 30, 1983.** Napier, J.C. (Solar Turbines International, San Diego, CA (USA)). 15 Dec 1983. Contract AC22-83PC60418. 14p. NTIS, PC A02/MF A01. Order Number DE84004894.

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The first quarter of progress in this project to demonstrate feasibility of an impact separator system for removal of suspended ash particles from a coal combustor hot gas stream is reported here. Design and performance predictions of the preliminary experiment module for interface with Solar's pilot scale coal combustor have been completed. This module will be used to gather design information for particle separation and transport from the combustion stream in both low temperature dry ash conditions and high temperature ash slagging conditions. 9 figures.

7139 **(PB—83-246041) Mine-related stream alteration practices for protection and enhancement of fish and wildlife. Final report.** Robb, A.E. Jr.; Ohlsson, K.E. (Baker (Michael), Jr., Inc., Beaver, PA (USA)). Oct 1982. 171p. NTIS, PC A08/MF A01.

The document should provide coal mining operators, surface mining management agencies, and other persons involved with potential and planned alterations to small streams located on and adjacent to surface mine sites with current information on practices to minimize harmful impacts to fish and wildlife resources. Stream alterations adverse to biological communities are identified and measures employed to counteract negative aspects of stream alterations are described in the report.

0109 Environmental Aspects

REFER ALSO TO CITATION(S) 7160, 7361, 8512, 8547, 8565

7140 **(EUR—8360-Vol.1-2-EN) Prediction of strata stability from instrumentation and modelling data. Volume 1 and Volume 2 (Report on ECSC contract 7220-AC/811).** (Commission of the European Communities, Luxembourg). 1983. 193p. Commission of the European Communities, Luxembourg.

The first volume describes the establishment of the necessary research facilities to investigate strata deformation around mine excavations. In particular, existing borehole instrumentation systems were improved, a computer-based system for processing and storing investigation results was developed, and the performance of a finite difference mathematical model was enhanced. The second volume discusses the application of the research facilities developed. Results obtained from these investigations were subsequently used to examine the accuracy of theory predicting the extent of yield zones, and to assist the validity of the finite difference model. (28 refs.)

7141 **(KHM-TR—50) Waste water from coal fired plants.** Persson, K. (AaF Energikonsult AB, Stockholm (Sweden)); Nordin, M. (Industrins Processkonsult AB, Stockholm (Sweden)). (Statens Vattenfallsverk, Vaellingby (Sweden). Projekt KOL-HAELSA-MILJOE). Feb 1983. 62p. (In Swedish). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84750091.

The volumes of waste water flows and their contents of various pollutants are dependent on the quality of the coal, the degree of enclosure of the system, the firing technique, the type of ash handling system and the design of the flue gas desulfurization system. The size of the plant is also of importance. The waste water from wet handling systems for fly ash includes high contents of cadmium, zinc and sulfate. Depending on the composition of the coal, scrubbing may release chloride, sodium, cadmium, boron, nickel, mercury and selenium. The waste water from cleaning of the air preheater and furnace surfaces of the boiler has high contents of zinc, iron, nickel and chromium. Alkaline detergents as well as organic compounds, including PAH may occur, depending on the soot content of the deposits. The metals in the waste water originate primarily from the products of corrosion.

7142 **Engineering and air quality analysis for the Tennessee Synfuels Associates coal-to-gasoline facility.** Malk, D.P.; Fillo, J.P.; Iwanchuk, R.M.; Jonardi, R.J.; Morris, M.G. (Koppers Company, Inc., Pittsburgh, Pennsylvania). *Proceedings, Annual Meeting, Air Pollution Control Association;* **82-22.4**: 31(Jun 1982).

On March 18, 1981 TSA filed a PSD permit application with the Tennessee Division of Air Pollution Control. A detailed engineering and air quality analysis was performed to fulfill the applicable regulatory requirements and consisted of an air emissions inventory, BACT analysis, and an analysis of the associated air quality impacts. Each specific design parameter and control technology selection was made after a thorough analysis of several alternatives to establish the approach that afforded the best level of control and minimized the air quality impact for each emitted pollutant. This assessment was based upon considerations of technical feasibility, and the associated economic and environmental aspects of each alternative. The PSD permit application set forth emission limitations that ensure the facility will not violate PSD increments and will maintain Tennessee's ambient air quality standards. The PSD permit was granted for TSA's 50,000 bpd coal-to-gasoline facility on October 7, 1981, seven months after its initial submittal date.

0110 Reserves And Exploration

REFER ALSO TO CITATION(S) 7156, 8651, 8652, 8653, 8654, 8655, 8656

7143 **(BMR—234) Investigations of the geology and hydrology of the Great Artesian Basin 1978-1980.** Habermehl, M.A. (Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia)). 1982. vp. Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

A review is given of the significiant literature dealing with the ground water development and investigations of the geology and hydrology of the Great Artesian Basin.

7144 **(BMR—235) Springs in the Great Artesian Basin, Australia: the origin and nature.** Habermehl, M.A. (Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia)). 1982. vp. Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia.

The origin and nature of springs in the Great Artesian Basin, Australia, is discussed.

7145 **(DOE/ET/14693—T11) Peat deposits of the Carolina Bays of North Carolina.** Ingram, R.L.; Otte, L.J.; Witner, T.W. (North Carolina Univ., Chapel Hill (USA). Dept. of Geology; East Carolina Univ., Greenville, NC (USA). Dept. of Geology). Nov 1983. Contract AC18-79ET14693. 42p. NTIS, PC A03/MF A01 . Order Number DE84004253.

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Of the approximately 500 Carolina Bays larger than 100 acres (3,000 ft. long) in the Coastal Plain of North Carolina, 96 contained at least 1 ft of peat. The 96 bays have a total of 35,000 acres of peatland containing 15 millions tons of moisture-free peat. Of these 96 bays, 43 have peat greater than 4 ft thick totaling 8,000 acres with 8 million tons of peat. The largest single deposit of peat greater than 4 ft thick contains 1.1 million tons in a 1,000 acre area. Two main types of peat are present: (1) a black, fine-grained, highly decomposed peat, and (2) a brownish, decomposed somewhat fibrous peat usually found at the base of the thicker peats. An average peat has 84% moisture, 6% ash, 0.2% sulfur, and a heating value of 10,000 Btu/lb.

7146 (NP—4770030, pp 591-618) **Exploration of bituminous coal deposits by surface development wells.** Barth, G.; Rabitz, A. [nd]. (In German). NTIS (US Sales Only), PC A99/MF A01.

In Status report 1982. Geotechnics and deposits. Vol. 2.

In this project partial regions of the reserve zones of the bituminous coal mining in the Saar and Ruhr district are investigated by seismology, development wells and corresponding geological-economic geological evaluations. The technical course and results of the wells in Saarwellingen-Hoxberg and Habach in the Saar district are presented. A total number of 20 development wells has been reached in the Ruhr district by 4 further wells. Selected geological-economic geological results of the exploration measures, including also 6 seismic investigations are described. The evaluations are not yet finished in both districts.

7147 (NP—4770030, pp 619-628) **Coal reserve calculation in the bituminous coal deposits of Northern Rhine-Westfalia and Saarland.** Juch, D. [nd]. (In German). NTIS (US Sales Only), PC A99/MF A01.

In Status report 1982. Geotechnics and deposits. Vol. 2.

In more than the half of the differentially calculatable deposits - corresponding to about 3/4 of the present mining zone-geological evaluation have been carried out and the data gathering has been finished in several cases. The identification of the geology and the calculation of the seams is carried out by programs of the mathematical-geometrical block model newly developed in this project. The connection of the present programs and data and further evaluation programs to a new data bank system improves the combination of the individual geological informations and extends the possibilities of different presentation of results. Geostatistical computing programs can be applied if the data density of the seam properties are sufficient.

7148 (NP—4770030, pp 629-634) **World coal recources and reserve data bank service.** Holtom, J.E.B.; Cope, J.H.R.; Duncan, S.V.; McDonald, K.A. [nd]. NTIS (US Sales Only), PC A99/MF A01.

In Status report 1982. Geotechnics and deposits. Vol. 2.

This report describes the construction of the project, its final structure, the progress made to date and indicates the method we are adopting to convert data into information. Having been set up as a result of the pressure of oil price rises in the early 1970's the exact role of the project has been evolved by the Service's International Executive Committee into collecting all relevant data on the most significant deposits of coal and lignite world-wide. To meet this requirement geologists and translators have been abstracting data and banking it for some five years. To check identified references and to include countries with known deposits but incomplete references, a questionaire was circulated. From the response to the questionnaire a series of personal visits was undertaken to fill in the gaps, initially concentrating effort towards the less well developed countries.

7149 (NP—4770030, pp 635-648) **Working range exploration in the carboniferous strata by horizontal wells of extensive length.** Bernauer, M. [nd]. (In German). NTIS (US Sales Only), PC A99/MF A01.

In Status report 1982. Geotechnics and deposits. Vol. 2.

The target of the project is to develop a directed core drilling process which enables borehole lenghts of about 1000 m at an utmost high inclination and direction accuracy under the conditions of the rollingly deposited Ruhr carbon in order to explorate working ranges. The deflection forces occuring at the transition of layers of different hardness could be compensated by planning respective stabilization systems. Borehole lengths of up to 1770 m could be attained at a core recovery of about 98%. The underground experiments were accompanied by practice-relating tests at the Institute for Deep Drilling and Petroleum Production of the TU Clausthal. The control of the deflection forces in the vertical plane could be solved by this means. The still necessary development of a process for the direction-true drilling in the horizontal plane and the testing of a new, less expensive after-drilling process for large lengths are the subject of a filed but not yet permitted continuation application.

7150 (NP—4770030, pp 649-662) **Occurence and stratigraphy of coal seams and sandstone series of the coal measures in Lower Saxony.** Hedemann, H.A.; Stancu-Kristoff, G.; Loesch, J.; Schuster, A. [nd]. (In German). NTIS (US Sales Only), PC A99/MF A01.

In Status report 1982. Geotechnics and deposits. Vol. 2.

The classification and mapping of the Coal Measures, particularly its coal seams and important sandstone series are carried out on the basis of well measurements in about 250 natural gas development wells. After the treatment of the Coal Measures steps Stefan and Westfal D in the preceeding years it is now reported about the treatment of Westfal C and B which are particularly important for their coal and gas content.

7151 **(USGS-PP—1065-B) Geology of the Cooper Ridge NE quadrangle, Sweetwater County, Wyoming.** Roehler, H.W. (Geological Survey, Reston, VA (USA)). 1979. 97p. GPO.

Includes Geological Survey maps.

The Cooper Ridge NE 7 1/2-minute quadrangle is 18 miles southeast of Rock Springs, Wyoming, on the east flank of the Rock Springs uplift. Upper Cretaceous rocks composing the Rock Springs Formation, Ericson Sandstone, Almond Formation, Lewis Shale, Fox Hills Sandstone, and Lance Formation. Paleocene rocks composing the Fort Union Formation, and Eocene rocks composing the Wasatch Formation are exposed and dip 5° to 8° southeast. Outcrops are unfaulted and generally homoclinal, but a minor cross-trending fold, the Jackknife Spring anticline, plunges southeastward and interrupts the northeast strike of beds. Older rocks in the subsurface are faulted and folded, especially near the Brady oil and gas field. Coal beds are present in the Almond, Lance, and Fort Union Formations. Coal resources are estimated to be more than 762 million short tons in 16 ends more than 2.5 feet thick, under less than 3000 ft of overburden. Nearly 166 million tons are under less than 200 ft of overburden and are recoverable by strip mining. Unknown quantities of oil and gas are present in the Cretaceous Rock Springs, Blair, and Dakota Formations, Jurassic sandstone (Entrada Sandstone of drillers), Jurassic and Triassic Nugget Sandstone, Permian Park City Formation, and Pennsylvanian and Permian Weber Sandstone at the Brady field, part of which is in the southeast corner of the quadrangle, and in the Dakota Sandstone at the Prenalta Corp. Bluewater 33-32 well near the northern edge of the quadrangle. Other minerals include uranium in the Almond Formation and titanium in the Rock Springs Formation.

0120 Mining

REFER ALSO TO CITATION(S) 7140, 7167, 7186, 7226, 8657

7152 **(ACIRL-PR—82-10) Evaluation of a tube bundle system for goaf atmosphere monitoring and detection of spontaneous combustion.** Humphreys, D.R. (Australian Coal Industry Research Labs. Ltd., North Ryde). Oct 1982. 52p. Australian Coal Industry Research Labs. Ltd., North Ryde.

The Corex tube bundle system was installed at Bowen No. 2 colliery, Queensland, and used to analyse and monitor gas samples drawn from a series of pipes laid in the goaf of a thick seam panel. The use of this system as a means of early detection of spontaneous combustion was evaluated. (3 refs.)

7153 **(ACIRL-PR—83-2) Gas drainage research for outburst prevention and control: field investigation at Bowen No. 2 Colliery, Collinsville.** Gray, I.; Truong, D. (Australian Coal Industry Research Labs. Ltd., Sydney). 1983. vp. Australian Coal Industry Research Labs. Ltd., Sydney.

Outburst problems in Bowen No. 2 mine, Collinsville, resulted in an investigation being initiated into the drainability of carbon dioxide seam gas, prior to mining. Laboratory, underground and theoretical analyses of the problem were conducted. Drainage was adequately described theoretically by a modified two phase reservoir simulator. Predictions of drainage times at varying borehole spacings have been made from the fundamental drainage parameters found.

7154 **(CSIRO-DAG-GCM—32) Dynamic properties of four Coal Measure rocks from the Utah Development Company Coal Mine, Blackwater, Queensland.** Nguyen, V.V. (Commonwealth Scientific and Industrial Research Organization, East Melbourne (Australia)). 1982. 15p. Commonwealth Scientific and Industrial Research Organization, East Melbourne, Australia.

This paper presents a study of the dynamic properties of coal measure rocks taken from the exposed highwalls of the Blackwater open cut coal mine. The effects of overburden blasting on slope stability are discussed, with reference to the correlation of ultrasonic velocity with sediment cementation.

7155 **(CSIRO-DAG-GCM—37) Study of pillar stability at Aberdare North Colliery, Cessnock, New South Wales.** Schlanger, H.P.; Tsaganas, S.; Enever, J.R. (Commonwealth Scientific and Industrial Research Organization, East Melbourne (Australia)). 1982. 46p. Commonwealth Scientific and Industrial Research Organization, East Melbourne, Australia.

A mathematical modelling study was performed to predict vertical stress on peripheral pillars surrounding an extracted area at Aberdare North colliery. The limits obtained for the number of pillars that can be removed safely agree well with the number of pillars from a back analysis of unstable workings.

7156 **(CSIRO-DAG-GCM—38) Geology of the highwall ramp 7, U.D.C.'s coal mine at Blackwater in Queensland, and its implications for blasting damage.** Nguyen, V.V. (Commonwealth Scientific and Industrial Research Organization, East Melbourne (Australia)). 1982. vp. Commonwealth Scientific and Industrial Research Organization, East Melbourne, Australia.

Geological investigations have been carried out on a newly exposed highwall, the site for a blasting study at the Utah Development Company's strip coal mine at Blackwater, Queensland. An assessment has been made of the lithological, petrological and structural characteristics of the upper portion of the Upper Permian Rangal Coal Measures at the site. Lithological and structural parameters seem to control the extent and the type of blast damage, which is manifested by displacement along bedding planes and (subvertical) fractures aligned parallel to the highwall crest.

7157 **(CSIRO-DAG-GCM—39) Regional study of the Clennakin Pit area, Goonyella mine. Final report.** Wooltorton, B. (Commonwealth Scientific and Industrial Research Organization, East Melbourne (Australia)). 1982. vp. Commonwealth Scientific and Industrial Research Organization, East Melbourne, Australia.

Piezometric measurements enabled conclusions to be drawn regarding identification of aquifers, probable groundwater flow paths in the proximity of the pit, and the effects of the groundwater regime of mining activity such as blasting. Ground movements, attributed to stress relief, assumed a slip stick mechanism in an ill defined time dependent relationship with excavation. Two major shear zones were identified and shown to extend well back from the highwall though no evidence of ground movement was obvious from the surface.

7158 **(CSIRO-DAG-GCM—41) Dynamic response of coal mine roof: some observations at Wallsend Borehole colliery.** Siggins, A.F. (Commonwealth Scientific and Industrial Research Organization, East Melbourne (Australia)). 1983. vp. Commonwealth Scientific and Industrial Research Organization, East Melbourne, Australia.

A dynamic Finite Element Analysis (DFEM) approach was used to model the roof behaviour using material properties obtained from a representative geological column. Both (1-D) and (2-D) DFEM models were used. A comparison of the experimental and DFEM results suggest that some of the salient features of the experimental results were reproduced in the models. At some sites, where heavy roof sag was apparent, it was assumed that delamination between layers in the roof was present. An attempt was also made to simulate these delaminations in the DFEM modelling.

7159 **(DOE/ET/14204—1477) Measurement of dynamic coalbed reservoir conditions required to design near-mine methane control activities in the Warrior coal basin. Final report.** Boyer, C.M.; Stubbs, P.B. (United States Steel Corp., Monroeville, PA. Research Lab.). Feb 1983. Contract AC21-79ET14204. 141p. NTIS, PC A07/MF A01. Order Number DE84000226.

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Nine vertical wells were drilled from the surface to the Blue Creek coalbed at US Steel's Oak Grove Mine as part of a study to measure dynamic coalbed reservoir conditions near mine workings. Three of the wells were installed in advance of mining and equipped to measure changes in fluid saturation; three wells were installed in advance of mining and produced to measure changes in gas and water production; and three wells were installed, stimulated, and produced. The results of the six unstimulated wells in advance of mining indicated an advancing mine face affects a small area of the coalbed ahead of the face. If the face remains stationary for a period of time, methane production continues to increase while water production decreases indicating the coalbed area affected by the face increases with time. The three production wells were stimulated with 50,000 gallons of foam. Two wells had proppant materials omitted, while one well had 10,000 pounds of 20/40 mesh sand added as proppant. Gas production from the two nonpropped wells was unsatisfactory, 12,000 and 27,000 cubic feet per day. Gas production from the well with the small amount of proppant was satisfactory, 49,000 cubic feet per day. Analysis of the gas production data was complicated by a number of variables: (1) interception of one wing of one of the hydraulic fractures 1-1/2 months after gas production started, (2) the approach of mining, and (3) the short gas production life. Inspection of the mine in the areas at the bottom of two of the stimulated wells indicated that (1) the unpropped stimulation created a short, narrow hydraulic fracture, (2) the propped stimulation created a long hydraulic fracture of substantial width. This indicates that proppant may be required to prevent closure of the fracture which is necessary for maximum gas production. 18 references, 18 figures, 15 tables.

7160 **(ICTIS/M—0166) Warwickshire coalfield first monitoring report working paper No. 5.** Carter, K.; Roberts, P. (eds.). (Lanchester Polytechnic, Coventry (UK)). May 1982. 79p. Lanchester Polytechnic, Coventry, England.

The first of a series of reports providing information relevant to the proposal to deep-mine coal in mid-Warwickshire, United Kingdom. The first part discusses the national energy situation and the difficulties involved in formulating an energy policy, then a brief history of coal mining in Warwickshire is presented. The second part compares experiments of the Selby and Belvoir coalfield, with the expansion of Coventry and Daw Mill collieries. The third, discusses the environmental and economic impact of the mining proposals.

7161 **(ICTIS/M—0167) Warwickshire coalfield second monitoring report working paper No. 8.** (Lanchester Polytechnic, Coventry (UK)). Jan 1983. 61p. Lanchester Polytechnic, Coventry, England.

The second in a series of reports providing information relevant to the proposal to deep-mine coal in mid-Warwickshire, United Kingdom. Emphasis is placed upon an updating of energy policy, a progress report on the Belvoir and Selby developments, the impact of coal mining on local income and expenditure, the experience of new mining developments in the West Midlands, the further examination of waste disposal and a detailed look at the economic impacts of coal mining.

7162 **(NP—3770157) Report on the activities of the mining authorities of the land North-Rhine Westphalia in 1981.** (Ministerium fuer Wirtschaft, Mittelstand und Verkehr des Landes Nordrhein-Westfalen, Duesseldorf (Germany, F.R.)). 1982. 99p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE83770157.

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A survey of the economic situation of individual branches of the mining industry and the structure and responsibility of the mining authorities is followed by a description of the activities in the fields of mining technology and safety, work safety, health protection and environment.

0130 Transport And Handling

REFER ALSO TO CITATION(S) 7134

7163 **(DOE/EV/04427—62) Evaluation of the effect of coal cleaning on fugitive elements. Final report, Phase III.** Ford, C.T.; Price, A.A. (Bituminous Coal Research, Inc., Monroeville, PA (USA)). Jul 1982. Contract AC22-77EV04427. 165p. (COO—4427-62). NTIS, PC A08/MF A01. Order Number DE84004103.

Trace elements in coal, including mercury, cadmium, lead, arsenic, and selenium, have been pointed to with increasing frequency over the past several years as potential environmental pollutants. One means of controlling potential trace-element problems as they relate to coal is to remove these trace constituents prior to combustion. The trace elements associated with the ash and pyritic sulfur might be removed during the coal-cleaning process. This report describes the continuation of the evaluation of coal cleaning as a means of reducing the level of trace elements in combustion emissions. In this third phase of the study, feed coal, clean coal, and refuse samples were obtained from six coal preparation plants to evaluate the effect of coal cleaning on trace and major elements. As a control, the six feed coals were also cleaned at the BCR laboratory. Based on the results, significant reductions were obtained in many of the trace elements reported to be pollutants when released during coal utilization. Additionally, washability data were demonstrated to be effective predictors of plant performance in trace- and major-element removal. No evidence was found that the preparation plant itself provided a source of trace-element contamination. The removal of trace elements from coal at the preparation plant has the potential for transferring potential problems from air pollution, as a result of burning the coal, to water or solid waste pollution from waste disposal sites and water run-off from those sites. Based on a strict RCRA evaluation, no problems were indicated from disposal of the refuse containing higher concentrations of trace elements than in the coal. From an evaluation based on EPA's Multimedia Environmental Goals, some problems may be indicated. 39 references, 3 figures, 53 tables.

7164 **(DOE/PC/51505—T1) Coal fluid properties: coal-water/coal-gas. Final report.** Klinzing, G.E. (Pittsburgh Univ., PA (USA). Dept. of Chemical and Petroleum Engineering). 1982. Contract FG22-82PC51505. 35p. NTIS, PC A03/MF A01. Order Number DE84004728.

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This report covers research conducted on coal water mixtures and gas-solid flow analysis. Under coal water mixtures (CWM) the following areas were investigated: (1) bend flow analyses for CWM; (2) bend analysis for commercial CWM; (3) comparison of ΔP linear for a variety of CWM; (4) modeling CWM long sweep pressure drops; and (5) pressure drop losses for CWM in 90° bends. Gas-solid flow analysis involved modeling in pneumatic conveying. 9 references, 13 figures, 1 table.

7165 **(ICTIS/M—0164) Coal in containers.** (Coal Research Association of New Zealand, Wellington). May 1983. 11p. Coal Research Association of New Zealand, Wellington.

The transport of coal by rail in containers is discussed. This system could overcome problems associated with coal transport, handling and storage. The limitations of existing containers are discussed. (Available from IEA Coal Research, quote ICTIS/M-0164)

7166 **(NE-SBT—82-32) Evaluation of sod peat.** Albertsson, N.; Hansen, R.; Stridsberg, B.; Tibell, R. (Naemnden foer Energiproduktionsforskning, Stockholm (Sweden)). Apr 1982. 78p. (In Swedish). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84750106.

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Trials on harvesting, handling and transportation of sod peat have been carried out. Due to unfavourable drying conditions at the end of the summer the quality of the sod peat was very poor. Six Finnish equipments for cutting sod peat were tested. The productivity of the cutting operations has been poor with great variations . Great amounts of sod peat was crushed under the tyres of the tractor during the turning of the peat for better drying. Two tractor-pulled, self-loading, collecting wagons were tested, both manufactured in Finland. They were designed for loads of 3 and 10 cu.m. respectively. The loading of sod peat in 110 cu.m. truck and trailer vehicles was also studied. Only 65 per cent of the maximum loading volume could legally be utilized during transportation. The handling and combustion studies were carried out at four heating plants. In the sloping grate furnace of Hylte Bruk there is a risk of very high combustion temperatures, which may cause damages on the brick walls and problems with melting ashes. The sloping (water-cooled) tube grate at Froevifors Bruk is more suitable. Fractionalized sod peat - or milled peat - is not possible to use in the sloping grate furnaces, as the peat angle of repose is different from that of wood fuels. At the district heating plant of Vaexjoe sod peat (mixed with wood fuels) could be used as fuel after minor modifications.

7167 **(NE-SBT—83-18) Peat harvesting machines and investigation of peat. Testing and study of methods.** Holmgren, K.; Lindqvist, T. (Naemnden foer Energiproduktionsforskning, Stockholm (Sweden)). 1983. 68p. (In Swedish). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84750104.

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During the summer - autumn 1982 six types of peat harvesting machines were tested, all mounted on the rear of farm tractors. The tests were designed to measure the harvesters production, tractor power requirements, operational reliability and safety. In addition measurements were made of the peat properties regarding fuel value, drying and crumbling. Peat harvested with machines had twice as high quantity of dry matter per unit of space as manually harvested peat after drying to the same moisture content. The machine reliability was good on all machines except PPal 06-80. Regarding operational reliability, a problem was experienced occasionally with plugging of the outfeed nozzel on the PK1. PPal 04-S and PPal 06-80 occasionally had collections of tree particles in front of the intake screw. Note that minor construction changes are continously made on the machine types. This can cause sizable changes in the machines properties.

7168 **(NP—4900391) Conflicts in coal transportation: unit trains and slurry pipelines.** White, D.M. (Texas Governor's Energy Advisory Council, Austin (USA)). 7 Feb 1977. 43p. NTIS, PC A03/MF A01. Order Number DE84900391.

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The overall technical, economic, environmental, institutional, and legal considerations of coal and lignite development in Texas is discussed. In summary, while the railroads appear to be capable of

transporting all of Texas coal needs, sufficient demand should exist to support both rail and pipeline usage. In the near-term, Texas consumers should economically benefit from coal slurry pipelines, but long-term benefits will depend on federal regulatory policies. (PSB)

7169 **(SLU-IVL-UPPSATSER—126) Importance of storage on peat quality. A pilot study.** Thoernqvist, T. (Sveriges Lantbruksuniversitet, Uppsala. Institutionen foer Virkeslaera). 1983. 26p. (In Swedish). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750097.

The effect of storage on peat quality has been studied. Three piles have been studied, each containing approximately 55 m^3 of peat. In one of the piles milled peat was stored which contained 15 percent water at the time the pile was laid up. The second pile consisted of sod peat with a moisture content of 41 percent. The third pile was peat which had been dewatered with the Multibelt method to a moisture content of 77 percent. The storage period lasted form August 1982 until January 1983. The temperature in the Multibelt-dried peat pile was up to 10degreeC above the surrounding area outside during the entire storage period. The temperature in this pile was registered at six measurement points. The average moisture content value increased in the pile with the milled peat up to 27 percent, and in the pile with the sod peat up to 44 percent. In the pile with Multibelt-dried peat the average moisture content did not change during the storage period. The dry substance loss, based on loss of organic material in nylon net sacks, was 1.3 percent in the milled peat pile, 2.9 percent in the sod peat pile and 0.8 percent in the Multibelt-dried peat pile. Ash content increased in milled and sod peat from 1.3 percent to 1.7 percent, i.e., an increase of about 30 percent. In the Multibelt-dried peat, however, a reduction was noted in the ash content from 12.3 to 6.5 percent.

7170 **Effect of fracture modes on shape and size of coal particles and separation of phases.** Lytle, J.M. (Battelle, Pacific Northwest Lab., Richland, WA); Bunnell, L.R.; Prisbrey, K.A. *American Chemical Society, Division of Petroleum Chemistry, Preprints;* **28**: No. 5, 1203-1207(Sep 1983). (CONF-830814—Vol.2). Contract AC06-76RL01830.

From 186. national meeting of the American Chemical Society; Washington, DC, USA (28 Aug 1983).

During coal grinding, the modes and mechanisms of fracture change with time and particle size. Fracture tends to proceed preferentially along organic-to-organic interfaces, then along mineral-to-organic interfaces and cracks and pores. Particles with limited porosity and mineral inclusions are the strongest particles and tend to be ground at slower rates. Modeling studies indicate that 2 sets of comminuition rate constants are required to model the grinding of lignite, since weaker components control the rates initially, while stronger components control the rates later in the process. In producing and using coal-liquid slurries, important factors include coal-to-liquid ratio, rheological properties of slurry, particle size distribution and mineral content. The shapes of particles may have a marked effect upon slurry viscosity and upon the packing density of slurries. The potential for removal of mineral impurities increases with grinding time. However, the potential for removal of organic sulfur may be greater at an intermediate stage of grinding. Detailed knowledge of the coal grinding process may increase the potential for efficient and environmentally safe use of coal. 3 figures, 2 tables.

0140 Combustion

REFER ALSO TO CITATION(S) 7082, 7166, 7338, 8205, 8280, 8535

7171 (CONF-830381—, pp 23-51) **Emissions, efficiency, and combustion chamber conditions of a smokeless, hand-fired coal heater.** Waslo, D.; Jaasma, D.R. (Virginia Polytechnic Inst. and State Univ., Blacksburg). Aug 1983. NTIS, PC A10/MF A01.

From Solid fuel heat technology symposium; Baltimore, MD, USA (11 Mar 1983).

The emissions, efficiency, and combustion chamber conditions of the Rayburn Prince 76, a clean-burning coal heater developed by the British, have been studied to determine if the downdraft design of the Prince gives low emissions when operated on American coals. Temperatures and species concentrations were measured in the secondary combustion chamber of the unit. Temperatures and gas residence times in the secondary combustion chamber were found to range from 440 to 1040°C and 15 to 40 ms, respectively. Little soot and hydrocarbon oxidation probably occurred in the chamber, due to the relatively low temperatures and short residence times. The emissions and efficiency of the heater were determined for operation on two bituminous coals at both high and low firing rates. The CO, NO/sub x/, SO/sub x/, and smoke emission factors ranged from 38 to 120, 1.2 to 5.8, 3.3 to 5.4, and 2.3 to 16 g/kg, respectively. The smoke emission factors were up to six times lower than those found using identical coals in updraft stoves. The overall efficiency was measured using a stack-loss method and ranged from 54 to 60%. The sensible energy losses were found to represent the majority of the total energy losses. An appendix describes the real-time measurement of CO and total organic carbon (hydrocarbons and partially oxidized hydrocarbons) to obtain an estimate of the non-CO portion of the chemical energy loss of a woodstove or coalstove. 18 references, 8 figures, 4 tables.

7172 **(NE-SBT—83-7) Skellefteå fuels. Production plant for solid fuels. Peat, forest raw materials, household and industrial waste - preparatory study.** Hjaelm, B.; Liljeblad, H.; Lindqvist, L.; Strand, H.O. (Naemnden foer Energiproduktionsforskning, Stockholm (Sweden)). Sep 1982. 224p. (In Swedish). NTIS (US Sales Only), PC A10/MF A01. Order Number DE84750109.

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This is a preliminary study of alternative systems of refining solid fuels in the region of Skellefteaa. The following raw materials are dealt with peat, logging residues, waste wood, industrial and household waste. Evaluation of site and techniques is presented, the investigation covering, storage processing, refining and storage. The localizing of a peat pellet plant at Roejnoret is recommended. The processing of forest products should be integrated with peat processing, Industrial and household waste should be used, possibly by incineration. Economic calculations point out a plant with a capactiy of 100000 ton pellets per year, which requires an investment of 170 MSEK. The capacity is almost 3 times higher than needed for the district heating center at Hedensbyn. Complementary investigations are anticipated.

7173 **MHD generator performance comparisons between coal + ash firing.** Petty, S.; Enos, G.; Kessler, R.; Swallom, D. (Avco Everett Research Laboratory, Inc., Everett, Massachusetts 02149). *Proceedings, Intersociety Energy Conversion Engineering Conference;* **1**: 118-124(Aug 1983). (CONF-830812—).

From 18. intersociety energy conversion engineering conference; Orlando, FL, USA (21 Aug 1983).

A two-stage slagging coal combustor developed by TRW Corporation, was successfully integrated with an MHD generator developed by the Avco Corporation, when the two companies cooperated in an operational demonstration of a coal fired MHD power train under the sponsorship of DOE. The experimental components, rated at a nominal 20 MW thermal input, are the engineering prototypes of 50 MW /SUB th/ hardware to be supplied by the contractors to the recently commissioned Component Development and Integration Facility (CDIF), a federal MHD test site in Butte, Montana. A second series of tests was conducted in which the same channel and operating parameters were employed with an oil-fired ash-injected combustor (AIC) to provide performance comparisons. The only significant performance variation uncovered in the comparison tests was attributable to a non-optimum method and location for seed injection in the coal-fired combustor. The corrective measures are deemed to be relatively straightforward.

7174 **MHD coal combustor development for low preheat operation.** Bauer, M.; Braswell, R.; Iwata, H.; Stewart, J. (TRW Energy Development Group, Redondo Beach, California). *Proceedings, Intersociety Energy Conversion Engineering Conference;* **1**: 125-130(Aug 1983). (CONF-830812—). Contract AC22-81PC40502.

From 18. intersociety energy conversion engineering conference; Orlando, FL, USA (21 Aug 1983).

As part of the DOE supported TRW coal-fired MHD combustor development project, a test program was initiated to investigate what changes would be needed to operate the "high preheat" 20 MW /SUB t/ combustor at low air inlet preheat conditions. This paper presents the results of this test program with emphasis on describing the low preheat combustor concepts that were considered, the specific configuration that was selected for fabrication and the results from testing the 20 MW /SUB t/ combustor under low preheat conditions.

0150 Marketing And Economics

REFER ALSO TO CITATION(S) 7160, 7161, 7168, 7213

7175 (DOE/CS/24204—T1) Feasibility study of transferability of Mercer County EDB to five county lignite development impact area. Final report. (Southwest Arkansas Planning and Development District, Inc., Magnolia (USA)). Dec 1981. Contract FG01-80CS24204. 52p. NTIS, PC A04/MF A01. Order Number DE84004299.

This is the final report on the study of the Transferability of the Mercer County, North Dakota Energy Development board concept to a multi-county approval in the lignite development area of South Arkansas. This report will concentrate on the three major tasks of the study which are to analyze the potential impacts associated with the anticipated growth and to develop impact projections based on this analysis, to heighten public awareness of the potential impacts of lignite development in the area, and to analyze various growth management systems, especially the Energy Development Board Concept, and to recommend one system for implementation. This report concludes that the EDB concept as utilized in Mercer County should not be transfered to a multi-county approach in South Arkansas. This conclusion is reached because of the folowing reasons: (1) The EDB is unnecessarily duplicative of both the Defense/Energy Task Force Group and the Planning and Development District, both of which are heavily involved in local energy issues and growth management efforts. (2) There is no financing mechanism similar to the Coal Impact Office of Arkansas. This offer has been a key in the success of North Dakota's efforts. (3) No strong local support for planning exists in Arkansas as it does in North Dakota. The report goes on to recommend that the two existing organizations which have been providing planning, management assistance, and policy direction continue to do so. These two organizations are those mentioned in (1) above.

7176 (DOE/EIA—0333(83)) 1983 annual outlook for US coal. Paull, M.K. (USDOE Energy Information Administration, Washington, DC. Office of Coal, Nuclear, Electric and Alternate Fuels). Nov 1983. 32p. NTIS, PC A03/MF A01 - GPO. Order Number DE84004944.

This report highlights projections and discusses them in relation to coal's future domestic uses; the report also examines factors affecting coal's future growth. Coal was the primary source of energy in the United States from the mid-1800's until after World War II. After that war, coal lost most of its markets to oil and natural gas. In the 1960's, coal development was also hampered by environmental and mine safety concerns, and by the emergence of nuclear power. The 1973-74 oil embargo, however, demonstrated that the United States could no longer depend on imported oil to fuel its energy growth. Through 1990, coal is projected to meet an increasing share of total US energy demand. The projections for the 1985 to 1990 time period show an increased growth in coal consumption, particularly in the electric utility sector where new coal-fired power plants are coming on line. The projected growth in coal production, however, is subject to a series of potential constraints and/or obstacles that must be overcome. These potential constraints and obstacles are described after the history of coal supply and demand is reviewed and future projections are discussed.

7177 (GAO/RCED—83-212) Status of the Great Plains coal gasification project - Summer 1983. (General Accounting Office, Washington, DC (USA). Office of the Comptroller General). 20 Sep 1983. 30p. General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760.

Report to The Congress.

Construction of the Great Plains coal gasification plant in North Dakota was 3 weeks behind schedule as of May 31, 1983, but cumulative project costs were less than originally estimated. A March 1983 analysis by Great Plains raised questions about the project's economic viability, which is closely linked to future energy prices. The estimated gas prices used in the analysis were lower than those used in January 1982 to justify construction. As a result, the project's investors are concerned about possible losses during the early years of operations. GAO's review shows, however, that Great Plains did not consider substantial tax benefits which may be available to the parent companies of the project's investors. If these benefits are considered, the project's economic viability could be more positive. Should the investors end their participation, some tax benefits previously obtained would have to be repaid.

7178 (NE-SBT—83-12) Peat-fired condensing power plants in Sweden. Hardell, R.; Hellman, L.G.; Palmberg, B.; Soerensson, G.; Ranta, P.; Groenfors, T.; Huopalahti, K. (Naemnden foer Energiproduktionsforskning, Stockholm (Sweden)). 1983. 148p. (In Swedish). NTIS (US Sales Only), PC A07/MF A01. Order Number DE84750108.

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A possible way of utilizing the relatively large quantities of peat in thinly populated areas in Sweden is to build peat-fired condensing power plants in the vicinity of peat bogs. It may also be of interest to use the excess heat in the plants for production of peat pellets or briquettes. The objective of the present study has been to investigate the feasibility of peat-fired condensing power plants in Sweden. A 250 MW power plant has been described in the report. The estimated cost for electric power production in this plant is 292 SEK/MWh. An independent study of an 85 MW power plant has been made, the cost for power production is about 250 SEK/MWh. One conclusion of the report is that very large bog areas will be needed for the supply of a power plant with milled peat. The production of milled peat is highly dependent on the season and the weather. Cost reductions for peat production are of great interest as the fuel costs in a peat-fired power plant correspond to about 2/3 of the total specific production costs. Different techniques for the reduction of the water content in the peat have been reviewed. No significant reductions of the power production costs can, however, be anticipated. As a concluding remark one may say that the feasibility of large peat-fired condensing power plants is to a great extent dependent on the development of effective peat winning techniques.

7179 (NP—3770166) Rheinische Braunkohlenwerke A.G.: Report of the business year 1981. (Rheinische Braunkohlenwerke A.G., Koeln (Germany, F.R.)). 1981. 43p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83770166.

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As one can learn from the business report of the Rheinische Braunkohlewerke for 1981 the total investments were increased by 339.8 million DM to 1279.8 million DM in the year before (including fixed assets of 971.3 million DM and stock capital of 284.2 million DM). The investments for assets were especially concerned with surface mines, i.e. particularly the new Hambach mine being developed East of Dueren. The financial investments are mainly due to the company's ventures in American black coal mining. In the year under report 119.2 x 10^6 t of brown coal were produced, 100.8 x 10^6 t being used for the power plants of the RWE. The Rheinbraun benefication industries had processed 16.9 x 10^6 t, mainly for the production of 4.2 x 10^6 t of brown coal briquettes and 2.3 x 10^6 t of brown coal dust. The turnover yields amounted to 2.652,9 million DM. The raise was chiefly due to price increases. On the whole, the results of the company could be kept stable. After having withheld 25 million DM (5 millions in the previous year) for the flexible reserve-fund unchanged Rheinbraum payed over an unchanged dear profit of 52.8 millio. DM to its parent company RWE according to the agreements.

7180 (NP—3770167) Ruhrkohle A.G.: Business report 1981. (Ruhrkohle A.G., Essen (Germany, F.R.)). 1982. 104p. (In German). NTIS (US Sales Only), PC A06/MF A011. Order Number DE83770167.

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The report of the executive board points out the unsatisfying financial situation of the company. The reasons for this lie in the cost increases and the retrograde demand for coal and coke. Then the activities outside of mining are dealt with, the annual concern balance is explained a loss and profit account are presented.

7181 (NP—3770169) Verein Deutscher Kohlenimporteure: Annual report 1981. (Verein Deutscher Kohlenimporteure e.V., Hamburg (Germany, F.R.)). Jul 1982. 122p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE83770169.

In a retrospective and forward view the factors influencing the coal trade (total economic development, world supplies, demand, political decisions, power plant construction, etc.) are dealt with and the sales prospects for imported coal in the F.R. of Germany are investigated. Tables and reports on various countries follow.

7182 (NP—4770038) Rheinbraun 1982: Report on the business year 1982. (Rheinische Braunkohlenwerke A.G., Koeln (Germany, F.R.)). 1983. 45p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84770038.

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The "Report on the business year 1982" of the Rheinische Braunkohlenwerke Aktiengesellschaft (Rhinean brown coal works, Inc.) contains the annual balance and the business report. The developments in mining (including open pits, drilling operations and mine drainage, acquisition of land and resettlement and recultivation) and in coal refining (production of brown coal briquets, brown coal dust and brown coal coke) in the year 1982 are discussed. It is also reported about research and development works and of emission protection. Further themes are the sales and profit situation, investments and financing and employees and social conditions.

7183 (NP—4770039) Ruhrkohle A.G.: Business report 1982. (Ruhrkohle A.G., Essen (Germany, F.R.)). 1983. 101p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84770039.

Portions are illegible in microfiche products.

The "Business report 1982" of Ruhrkohle Aktiengesellschaft (Inc.) contains the report about the situation of the company, the trust activities and the annual balances. In the article "The bituminous coal and the energy economy" the energy economical situation in the world and in the Federal Republik of Germany, the situation of the bituminous coal mining and the energy and coal policies are discussed. Research and development works have been carried out in the fields of mining technology/working safety, surface technique/preparation, coking technique, power generation, new technologies of the coal refining and the combustion technique for the heat market.

7184 (NP—4770041) Annual report 1982 - Verein Deutscher Kohlenimporteure. (Verein Deutscher Kohlenimporteure e.V., Hamburg (Germany, F.R.)). Jul 1983. 112p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84770041.

The Association of German Coal Importers evaluates in the "Annual Report 1982" the development of the coal sector (reserves, production, transport, trade and consumption) in the world and in the Federal Republic of Germany in the year 1982 and presents an outlook to the development in the next years. The national reports illustrate the specific situation in different countries and economic blocks. The import report gives figures from the import and export of bituminous coal, bituminous coal coke and bituminous coal briquets.

7185 (PB—83-256487) Prospective expansion - black coal industry: Australia - New South Wales. (Joint Coal Board, Sydney (Australia)). Oct 1980. 55p. NTIS, PC E04/MF.

The Australian coal industry is being called on to play an important role in meeting the demand for energy, both locally and overseas. The industry has a sound foundation on which to build. Both New South Wales and Queensland have large resources of black coal which are relatively accessible and which include coals suitable for most applications. The industry uses modern mining methods and productivity is high. The study found that demand in the export market could grow even more rapidly than demand in the local market. Coal importers will be looking to Australia to supply at least 115 M tonnes in 1990 and possibly as much as 180 M tonnes.

0160 Health And Safety

REFER ALSO TO CITATION(S) 7153, 7338, 8632

7186 (IOM-TM—83-15) Measurements of the static electrification of airborne dusts in workplaces. Vincent, J.H.; Johnston, A.M.; Jones, A.D.; McLachlan, C.Q. (Institute of Occupational Medicine, Edinburgh (UK)). Sep 1983. 121p. Institute of Occupational Medicine, Edinburgh, Scotland.

The project described investigated the static electrification of airborne dusts in workplaces, so that effects on lung uptake of workers and dust filtration could be assessed. Instrumentation was developed to give the median magnitude of charge carried by particle and the charge distribution. Experiments were carried out at 48 workplaces and in the laboratory. (32 refs.)

7187 (PB—83-254946) Pneumoconiosis, lung function and exposure to airborne dust: epidemiological research to compare responses of working coalminers with responses of ex-miners. Part 2. Final report. Soutar, C.A.; Maclaren, W.; Hurley, F.; Murdoch, R.; Hadden, G. (SEE CODE-9050430 Institute of Occupational Medicine, Edinburgh (UK)). Mar 1982. 95p. (TM—82/5). NTIS, PC E06.

The relationship between dust exposure and disease for miners was compared with that for ex-miners, in order to determine whether relationships found in other studies on miners alone could be applied to both groups. 17,738 men examined in the 1950s were followed up approximately 22 years later. Sixty one per cent of the survivors were examined, being 40% of the original sample. Records were made of respiratory symptoms, smoking habit, lung spirometry and chest radiograph findings. Radiographs were interpreted according to the International Labour Office Classification of Pneumoconiosis. Lifetime dust exposure was calculated for each subject. The dust/disease relationship was found to be the same for both groups. Ex-miners were found to have more pneumoconiosis and fibrosis and to be in worse health than miners. Pneumoconiosis progression was shown to be related to continued dust exposure; fibrosis progression was related to the presence of dust in the lungs. Dust exposure was shown to cause a mainly restrictive pattern of lung disease in contrast to the obstructive pattern caused by smoking. Colliery-related differences were found in lung disease which it was felt needed further investigation.

02 PETROLEUM

0201 Reserves

REFER ALSO TO CITATION(S) 7235

0202 Geology And Exploration

REFER ALSO TO CITATION(S) 8665, 8666

7188 (DOE/EIA—0423) Petroleum resources of Mexico. Dietzman, W.D.; Jirik, C.J.; Lyle, W.E. Jr.; Rafidi, N.R.; Ross, T.A. (USDOE Energy Information Administration, Washington, DC. Office of Oil and Gas). Oct 1983. 109p. NTIS, PC A06/MF A01 - GPO. Order Number DE84003980.

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This report presents an analysis of the discovered crude oil resources, reserves, undiscovered recoverable crude oil resources, and estimated annual production from oil fields in Mexico. Estimates of total recoverable crude oil in Mexico and an analysis of

the potential rates at which crude oil might be produced and enter into world markets are given. This analysis does not take into account the possible supply of recoverable resources from such nonconventional deposits as tar sands and oil shale. The main export markets for Mexican crude oil in 1981 were, in order of importance, the United States, Western Europe, the Caribbean, and the Far East. Mexico has actively attempted to expand its export position only recently, after internal supply gradually exceeded demand.

7189 (NP—4770030, pp 1023-1040) **New methods of the geochemical hydrocarbon exploration.** Stahl, W. [nd]. (In German). NTIS (US Sales Only), PC A99/MF A01.

In Status report 1982. Geotechnics and deposits. Vol. 2.

New methodical developments to improve the geochemical hydrocarbon explorations are discussed. It is differentiated between the indirect and direct exploration methods. The direct methods utilize the fact that hydrocarbons migrate from the producing parent rocks and hydrocarbon accumulations in small amounts to the surface and they can be analysed there. All works which d'out aim to detect the migrated compounds directly are included to the indirect methods. Research projects of BMFT which are carried out in relation to geochemical exploration methods are discussed.

7190 (NP—4770030, pp 1063-1073) **Quantitative basin simulation: Methods and possible application strategies in the petroleum exploration.** Ritter, U. [nd]. (In German). NTIS (US Sales Only), PC A99/MF A01.

In Status report 1982. Geotechnics and deposits. Vol. 2.

The work with a dynamic-deterministic basin model developed at the ICH-5 of the KFA requires careful selection and coordination of the used physical, geological and geochemical parameters. The essence of the course of the process consists of a series of experiments which are carried out by using a mathematical model for different assumptions (conceptional models) and at the end of which one or several probable or possible scenarios of the basin development is selected. The data obtained in this way allow the evaluation of the development of compaction, temperature, maturity, porosity and hydrocarbon potential and their correlations for each prefixed point in time and space. Quantitative basin simulation is possible in all stages of the exploration and it is suited for the point-for-point clear up of forthcoming problems as well as for the exploration-accompanying application.

7191 **Improvements in pulsed neutron capture logging.** Hall, J.E.; Jacobson, L.A.; Johnstone, C.W. (Schlumberger Well Service, Houston, Texas 77001). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-28: No. 2, 1680-1684(Apr 1981). (CONF-801111—).

From 6. conference on application of accelerators in research and industry; Denton, TX, USA (3 Nov 1980).

Pulsed neutron capture logs use miniature, sealed tube D,T neutron sources and provide measurement of the thermal-neutron decay time-constant or its inverse, the macroscopic capture cross section. These parameters prove useful in differentiating between oil- or gas-bearing formations and water bearing formations. Such logs are especially useful in detecting hydrocarbons in cased wells where traditional electrical measurements techniques are not applicable. Neutron capture logs are typically made by irradiating a formation with bursts of fast (i.e., 14 MeV) neutrons and measuring the decay of the thermal neutron density in the formation. This is accomplished by counting the gamma rays emitted by formation nuclei during discrete time intervals, or gates, following each neutron burst. Today, the most widely used pulsed-neutron logging system consists of a sliding-gate system in which three measurement gates are utilized. The first two gates are timed to detect the formation capture gamma rays. Such a system and the physics behind it was described four years ago at this conference.

0203 Drilling And Production

REFER ALSO TO CITATION(S) 7235, 7241, 8043, 8162, 8205

7192 (CONF-790913—11) **Starch-acrylamide graft copolymers for use in enhanced oil recovery. Paper SPE 8422.** Pledger, H. Jr.; Meister, J.J.; Butler, G.B. (Florida Univ., Gainesville (USA)). 1979. Contract AS05-78ER05947. 11p. Society of Petroleum Engineers of AIME, 6200 N. Central Expwy, Dallas, TX 75202.

From 54. annual SPE technical conference and exhibition; Las Vegas, NV, USA (23 Sep 1979).

Starch-acrylamide, graft copolymers are effective but shear-sensitive viscosifiers which, when synthesized with 18 or less grafts per starch molecule, duplicate the rheology of acrylamide homopolymer of 1 to 3 times higher molecular weight. Solutions of copolymer must be prepared at shear rates below 100 sec^{-1} and loss up to 40% of their viscosity when filtered through 0.45 μ pores. Copolymers with 18 or less grafts per starch molecule have higher intrinsic viscosities, higher solution viscosities, and higher solution screen factors than equal molecular weight homopolymers and all three properties of the copolymer increase with increasing molecular weight or decreasing number of grafts. The viscosity of copolymer solutions drops by less than 3% when sodium chloride concentration varies from 0 to 10,000 ppM or calcium ion concentration varies from 0 to 1000 ppM. Solutions of copolymer may lose up to 60% of original viscosity from 100 shearings at a rate of 4300 sec^{-1}. Sensitivity to shear increases with increasing molecular weight and, at constant molecular weight, increases with decreasing number of grafts. Loss of solution viscosity under successive shearings can be expressed with a modified Williams-Watts equation. 25 references, 17 figures, 1 table.

7193 (DOE/BC/10257—59) **Mathematical methodology for evaluating simulations of flow in porous media. Final report, February 1, 1980-August 31, 1983.** Ford, W.T.; Anderson, R.M. (Texas Tech Univ., Lubbock (USA). Dept. of Mathematics). Jan 1984. Contract AC19-80BC10257. 170p. NTIS, PC A08/MF A01. Order Number DE84004775.

This report concerns development of a methodology for evaluation of reservoir simulators. Although validity and usefulness of reservoir simulations might be questioned on various grounds, this study involves tests of resolution of numerical computational difficulties and of compatibility of correlations used in representation of fluid properties and phase flow interference. A similarity concept is used which allows testing of simulators to be based on solution of a system of ordinary differential equations, referred to as a Similarity Porous Media System (SPMS), rather than on the usual system of partial differential equations, referred to as a Porous Media System (PMS). The SPMS can be solved with the same computational effort as would be required for a single time step in the usual application of the PMS itself. The SPMS consists of study of possible level curves, also called similarity curves, on which all the unknowns in the PMS are constant. The curves can be chosen to be either a family of coaxial, common vertex parabolas or of parallel lines for evaluation of a simulator restricted to a linear reservoir. Moreover, the SPMS can be used, on a family of parabolas, for a simulator restricted to porous media problems with circular symmetry. Simulation of an actual reservoir problem imposes field conditions on a simulator's solution of the PMS, but use of the similarity concept in evaluation of a simulator involves imposition of selected samples from a solution of the SPMS as conditions on a solution of the PMS by the simulator. Then, this solution of the PMS can be checked against a solution predicted by the solution of the SPMS. Examples have been tested and data are available on request. 7 references, 2 figures, 5 tables.

7194 (DOE/BETC/SP—83/27) **Bartlesville Energy Technology Center enhanced oil recovery project data base.** French, T.R.; Ray, R.M. (USDOE Bartlesville Energy Technology Center, OK). Jan 1984. 177p. NTIS, PC A09/MF A01. Order Number DE84003711.

A comprehensive EOR project data base that is validated, integrated, and continuously maintained and updated is being developed at BETC. The data base, which is not currently available to

the public, provides an information resource to accelerate the advancement and applications of EOR technology. The primary sources of data have been specific EOR Projects certified in the Incentives Program, the DOE Cost-Shared Tertiary Program, and a data base of ongoing EOR projects supplied by Gulf Universities Research Consortium (GURC). Information from these sources has provided an extensive basis for the development of a comprehensive data base relating the key parameters for EOR projects in the United States. The sources and types of data within the data base are organized in a manner which will facilitate information transfer within the petroleum industry. 28 references, 3 figures, 2 tables.

7195 (NP—4770030, pp 729-752) **Present experiences in the development of suitable chemical floodings technologies in laboratory scale.** Pusch, G. [nd]. (In German). NTIS (US Sales Only), PC A99/MF A01.

In Status report 1982. Geotechnics and deposits. Vol. 2.

It is reported about the investigations of the working cooperation 'Chemical flooding' about the developments on the flooding technological section. Different pore space models have been developed. They allow the examplary representation of certain reservoir facts according to their geometry and the nature of the porous medium (sand or core). They also enable the modelling of relevant physical and chemical effects in the displacement process. The economy in use of biopolymers and HEC polymers could be proven for the polymer flooding at high salinities. Ethoxylated surfactants have proven efficient in the surfactant flooding also at high salinities, making possible the adaptation of this phase behaviour to reservoir conditions according to the EO degree and degree of conversion.

7196 (NP—4770030, pp 753-772) **Viscous flooding: Development of suited flooding technologies and formulations of the material balance for flooding processes with viscous mediums.** Dietzel, H.J.; Reinhard, K.W. [nd]. (In German). NTIS (US Sales Only), PC A99/MF A01.

In Status report 1982. Geotechnics and deposits. Vol. 2.

By the use of polymer solutions a substantial increase of the degree of deoiling with respect to a comparable water flooding process can be attained. The flow properties of polymer solutions characterized by their rheological behaviour determine the deoiling effect of the polymer flooding process in the first instance. The injectibility of polymer solutions into the reservoir rock is another considerable criterion for the use of certain products. The dynamic stability of polymer slugs in the displacement process in the pore space is influenced by the interaction with the pore space matrix and the displaced flooding water. The residual oil saturation prior to the polymer flooding is a determining parameter for the dimension of the attainable increase of the degree of deoiling. The comparison of experiments in sand packings and sandstone cores shows that the pore space structure influences the attainable additional deoiling also.

7197 (NP—4770030, pp 773-786) **Development of selection criteria for polymer flooding additives under the special consideration of deposit-specific conditions.** Rehage, G.; Block, H.; Lange, W. [nd]. (In German). NTIS (US Sales Only), PC A99/MF A01.

In Status report 1982. Geotechnics and deposits. Vol. 2.

The viscoelastic behaviour and the long-term stability of polymer solutions are discussed as a further decision characteristic beside the selection criteria solubility, salt tolerance, filterability, high viscosity at low polymer concentrations which had been found out in the BMFT projects ET 3158 A and ET 1084 A. Polymer solutions undergo viscosity losses besides by the adsorption of polymers on the reservoir rock also by chemical influences. It can be demonstrated that besides oxidative degradation effects like they chiefly play a role for polyacrylamides also the hydrolytic degradation in mediums with low pH value lead to drastical viscosity losses of hydroxy ethyl cellulose and xanthane solutions. A superposition of the various effects is expected in the practice. Biogenic influences by the enzymatic degradation after bacteria growth can be controlled possibly in the deposit. The aim of the works is to develop suited stabilization measures and to test the possibility of a stabilization.

7198 (NP—4770030, pp 787-798) **Effectivity of bactericides for oil field waters and chemicals in the secondary and tertiary petroleum production.** Naeveke, R.; Schwartz, W. [nd]. (In German). NTIS (US Sales Only), PC A99/MF A01.

In Status report 1982. Geotechnics and deposits. Vol. 2.

Populations of microorganisms in the petroleum area (production plants, processing plants) have been analyzed more or less extensively with respect to their components (physiologically defined groups, taxa). The by far most of the microorganisms to be found in the produced reservoir waters and petroleum are not to be regarded as autochtone microorganisms of the petroleum reservoirs. Polymers used in the viscosity flooding (hydroxy ethyl cellulose, xanthane and polyacrylamide preparations) proved to be differently resistant toward microbial attack. Xanthanes were degraded more easily, polyacrylamide was resistant. Particularly accumulative cultures of desulfurizers have proved aggressive toward polymers under anaerobic conditions. The minimal inhibiting concentrations of 9 biocides proposed to protect the polymers in the viscosity flooding were determined by 18 of these desulfurizer accumulative cultures. The values were between 10 to about 1500 g/l.

7199 (NP—4770030, pp 799-810) **Surfactant flooding.** Neumann, H.J. [nd]. (In German). NTIS (US Sales Only), PC A99/MF A01.

In Status report 1982. Geotechnics and deposits. Vol. 2.

It is reported about the development of flooding mediums for a tertiary petroleum production by surfactant flooding. The presence of a microemulsion in the state of phase inversion has been found to be the condition for a residual oil mobilization. The microemulsion contains the entire surfactant. It is present in an equilibrium with each an oil phase (oil bank formation) and a water phase. The flooding medium contains a surfactant the HLB value of which is to be regulated according to salinity and temperature and a co-surfactant. The hydrophilicity of the surfactant and the so-surfactant is to be selected the higher the higher the salinity of the water is.

7200 (NP—4770030, pp 811-824) **Mechanisms of residual oil mobilization in a high salinity system.** Kraft, H.; Schuhbauer, W. [nd]. (In German). NTIS (US Sales Only), PC A99/MF A01.

In Status report 1982. Geotechnics and deposits. Vol. 2.

The phase behaviour of water/oil/surfactant systems is of particular importance for the residual oil mobilization in the surfactant flooding. Different ground states in the phase behaviour which exhibit their characteristics in deoiling experiments result depending on the boundary conditions like surfactant structure, temperature, oil composition and salinity of the reservoir water. Simple and reliable indicators for ethoxylated products are the phase inversion temperature and the interfacial tension minimum temperature. The phase inversion temperature was used to characterize the phase behaviour in laboratory flooding experiments. Important flooding-technological parameters like the occurrence of high pressure gradients in the surfactant flooding and the form of the oil bank were explained by a phase inversion the pore space.

7201 (NP—4770030, pp 825-838) **Retention behaviour of different surfactants at some reservoir rocks.** Beckmann, H.; Tauber, W.; Oezerler, M.; Steinber, T. [nd]. (In German). NTIS (US Sales Only), PC A99/MF A01.

In Status report 1982. Geotechnics and deposits. Vol. 2.

In the surfactant flooding, a partial field of tertiary measures to improve the degree of deoiling of petroleum deposits, additional deoiling is tried to be attained by the injection of surfaceactive compounds (surfactants). The investigations concern the problem of the loss of chemicals by the adsorption and retention of oil-mobilizing salt water-tolerant mixed surfactants in the pore space of petroleum reservoir rocks. The influences of flooding velocity, surfactant concentration, core dimension and pore space characteristics of sandstone samples are treated in particular. The experimental results show that high amounts of surfactants can be lost by adsorption and retention.

7202 (NP—4770030, pp 839-850) **Investigations as a basis to select and to plan field projects for the tertiary petroleum production by chemical flooding.** Albertsen, M. [nd]. (In German). NTIS (US Sales Only), PC A99/MF A01.

In Status report 1982. Geotechnics and deposits. Vol. 2.

The R and D efforts in the working group 'Chemical flooding' since 1974 were continued with the phase III of the cooperative research in this project since 1981. The structure and the aim of the cooperative project are presented in this report with respect to phase I (1974-1977) and phase II (1978-1981). The aim of the R and D work is to characterize the surfactant and polymer flooding medium under the specific boundary conditions of German petroleum fields by a meaningfully linked physicochemical and flooding technological investigation program.

7203 (NP—4770030, pp 851-868) **Increase in yield in petroleum reservoirs by carbon dioxide flooding.** Albertsen, M. [nd]. (In German). NTIS (US Sales Only), PC A99/MF A01.

In Status report 1982. Geotechnics and deposits. Vol. 2.

Starting with the target to estimate the possibilities of the application of the carbon dioxide flooding as a tertiary petroleum production process in German petroleum fields and to contribute to the improvement of the fundamentals for the planning of future field projects investigations have been undertaken in a working group of DGMK. In this report investigation methods and results of the working group are presented with concern to the following partial sections: - Investigations of the PVT and phase behaviour of six selected systems of reservoir oil/CO_2 concerning their importance for the dynamic deoiling process. - Investigations of the modelling description and the numerical treatment of the deoiling process. - Investigations of the less expensive provision of sufficient amounts of CO_2.

7204 (NP—4770030, pp 899-914) **Reservoir modelling for thermal production processes.** Murtada, H.; Fuchs, H.K.; Mohtadi, M. [nd]. (In German). NTIS (US Sales Only), PC A99/MF A01.

In Status report 1982. Geotechnics and deposits. Vol. 2.

For the modelling of a geothermal regime in a Canadian bitumen deposit relevant geological and deposit physical data were compiled as obtained from drilling results. Beyond this a plan for the construction of a bench-scale plant usable for thermal and thermally modified flooding experiments was worked out. For the numerical simulation of thermal flooding processes the main equations of a 2D-compositional model were linearized and discretized. This model was extended to a 3D geometry in order to describe the temperature, pressure and transport behaviour in the field. The extension of the model to steam gas mixtures has been already initiated. The determination of the heat propagation in the field was prepared by periodical temperature measurement in wells and by applications of geophysical measuring processes from the surface.

7205 (RISO-M—2394) **Selection of an enhanced oil recovery method.** Winter, A. (Danmarks Geologiske Undersoegelse, Copenhagen). (Risoe National Lab., Roskilde (Denmark)). Aug 1983. 72p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE84750085.

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This report deals with a group of petroleum recovery processes involving the introduction of some form of artificial energy into the reservoir. The physical and chemical mechanisms underlying the described processes are, however, much more sophisticated than those in conventional secondary recovery processes, such as water or gas injection. More specifically, the recovery methods described in the report can be divided into two broad classes, namely - heat injection or thermal methods, - improved fluid-injection methods (immiscible and miscible displacement). The methods belonging to the above mentioned classes are collectively referred to as enhanced oil recovery (EOR) techniques. The subjects discussed in the report are centered around two themes: - Overview of the most important problems in geology, geophysics, physical chemistry and reservoir engineering, which have impact on EOR processes, - Specification of criteria for deciding which particular recovery technique might be most applicable for a given set of reservoir conditions. The adopted structure of the report and its relatively limited scope should make it useful both as comparison of varous EOR strategies and as an introduction to the subject for those connected in any way with development and production of hydrocarbon reserves, but unfamiliar with enhanced recovery.

7206 **A model for interfacial activity of acidic crude oil/caustic systems for alkaline flooding.** Ramakrishnan, T.S.; Wasan, D.T. (Illinois Inst. of Technology). *SPEJ, Society of Petroleum Engineers Journal;* 23: No. 4, 602-612(Aug 1983). Contract AC19-79BC10069.

The interaction of the alkali in floodwater and the acids in reservoir crude results in the in-situ formation of surfactants, which are responsible for the lowering of interfacial tension (IFT) in caustic flooding. The extent to which IFT is lowered depends on the specific properties of the crude oil and the injection water. Therefore, it is important to establish the relationship between IFT and the essential chemical properties of the acidic oil and the floodwater. This paper presents such a relationship. In this discussion, the adsorption and the desorption of the active species at the interface are modeled as ionic processes using the Gouy-Chapman theory of the diffuse double layer. The interfacial potentials calculated using this model show a fair agreement with the experimentally measured trend of electrophoretic mobility. Also, the model rationalizes the experimentally observed effects of alkali concentration, salinity, and the oleic- to aqueous phase ratio on IFT. The authors conclude that the acid number of the crude oil may not correlate directly with interfacial activity. Even in cases of low-acid-number crudes, significant interfacial activity could be obtained because of highly hydrophobic active species in the crude.

7207 **Divalent ion exchange with alkali.** Bunge, A.L. (Lawrence Berkley Laboratory, Univ. of California). *SPEJ, Society of Petroleum Engineers Journal;* 23: No. 4, 657-668(Aug 1983). Contract W-7405-ENG-48.

Exchange of hardness ions is important in EOR with chemical additives. In both micellar/polymer and caustic flooding processes, multivalent ions released from rock surfaces can interact with anionic surfactants, rendering them preferentially oil soluble and/or insoluble in water. Because hardness cations are sparingly soluble and precipitate in alkaline solutions, such solutions may be more efficient as surfactant-flood preflushes than are softened brines. Multivalent ion precipitation may also occur in alkaline waterflooding. To permit design of such processes, this paper presents a chromatographic theory for simultaneous ion exchange with precipitation of divalent ions. Theoretical effluent histories and concentration profiles are presented for the cases of finite pulses and continuous injection of hydroxide ions into linear cores. Complete capture of the insoluble salt particles is assumed. Results are given for the case of instantaneous equilibration of the solution with the precipitate, as well as for the case of complete nonequilibrium, in which the solid precipitate does not redissolve. The theoretical model, when applied to field conditions, predicts redissolution zones that have not been previously recognized because solution residence times in laboratory columns are too short.

7208 **Physically scaled model studies simulating the displacement of residual oil by miscible fluids.** Doscher, T.M.; Gharib, S. (Univ. of Southern California). *SPEJ, Society of Petroleum Engineers Journal;* 23: No. 3, 440-446(Jun 1983). Contract AM03-76SF00113.

The displacement of waterflood residual oil by a solvent drive has been studied with scaled physical models of a line drive. This work was a first step in an overall study of the displacement of residual oil by CO_2. Some results of the subsequent study are presented for comparison. The usefulness and limitations of scaled physical models for studying the behavior of solvent displacement is analyzed, and it is concluded that such models are very useful for elaborating the mechanism of such a recovery process. Also, because the results obtained with such models correspond with field results, we believe that certain factors, which of necessity have been neglected in the scaling, play only a minor role in the performance of the process. This study concludes that the efficiency of CO_2 to recover residual crude oil is influenced primarily by gravity and viscous instabilities resulting from CO_2's low density and viscosity in comparison to water. It does not appear that CO_2 is any

more efficient, in terms of reservoir volumes, than a hydrocarbon-miscible solvent.

7209 **Rheology of mobility-control foams.** Patton, J.T.; Holbrook, S.T.; Hsu, W. (New Mexico State Univ.). *SPEJ, Society of Petroleum Engineers Journal;* 23: No. 3, 456-460(Jun 1983).

Enhanced oil recovery (EOR) studies have consistently demonstrated the need to mitigate gas channeling in processes involving use of gas to displace crude oil. The use of foam for gas mobility control was first investigated in 1955, and an early field test by Union Oil Co. of California indicated significant merit in the concept. Work was undertaken at New Mexico State U. to provide rheological data of in-situ-generated foam in an attempt to define the mobility-lowering mechanism. A capillary viscometer was constructed to measure the rheological properties of the most promising foams made with commercially available additives. Data collected at different shear rates show that foams are pseudoplastic in nature and several orders of magnitude more viscous, 10 to 100 cp (0.01 to 0.1 Pa X s) than their gas or liquid fractions. Significantly, foam viscosities are generally an inverse function of foam density, which is very advantageous in oil-displacement processes. In areas where gas fingering is pronounced, foam viscosity would be expected to increase with gas saturation and, thereby, would tend to mitigate further gas channeling. The spontaneous generation of a viscous foam phase may also serve to reduce the flowing gas saturation and, thus, lower gas mobility because of the relative permeability effect. This technology is easily adapted to the water-alternating-gas (WAG) process involving CO_2 or rich-gas displacement of oil.

7210 **A wellbore inertial navigation system.** Kelsey, J.R. (Sandia National Laboratories). *Society of Petroleum Engineers of A.I.M.E. (American Institute of Mining, Metallurgical and Petroleum Engineers), Paper;* IADC/SPE 11359: 41-46(Feb 1983). (CONF-830203—).

From IADC/SPE drilling conference; New Orleans, LA, USA (20 Feb 1983).

A prototype wireline tool which includes a downhole inertial platform and a surface computer to spatially map a well is described. The hardware consists of a single-gimballed inertial platform with accelerometers and gyros to obtain three-axis motion information. The gyroscope and accelerometer outputs are transmitted to a computer at the surface which calculates probe attitude relative to north, east, and vertical. Double integration of the accelerometer data provides the position information. A conventional 7-conductor wireline is used for the system data transmission. System accuracy is enhanced by advances made in the computer software which processes the data received from the tool. The software uses statistical sampling estimation to obtain optimal estimates of the system errors. Measurement errors are determined by periodically stopping the tool during the logging procedure and observing the indicated velocity measurements. This procedure, known as Kalman filtering, results in increased accuracy of the data. Present mapping systems have an X-Y-Z location accuracy of 100 to 200 feet for a typical well depth of 10,000 feet. Test results show that the new system is accurate to about 1 foot per 1000 feet of well depth. Unlike conventional systems, the inertial navigator does not require any sort of projection of the cable length (which may not be accurately known). Also, this system provides continuous data throughout the wellbore and logging speeds on the order of 10 ft/sec appear possible. The hardware and software associated with this mapping system are described and the recent field test results are reported.

0206 Health And Safety

7211 **(STF—25A82006) Norwegian Fire Research Laboratory: New laboratory facilities. Needs for studying hydrocarbon fires in offshore platforms.** Hovde, P.J. (SINTEF, Trondheim (Norway)). Dec 1982. 72p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE84750122.

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The reported work has been performed to evaluate the needs for indoor laboratory facilities to study hydrocarbon fires, primarily related to offshore platforms. After a presentation of the actual sites of a hydrocarbon fire offshore, i.e. the various platform areas and modules, various types of fires are presented. One of the most important topics to evaluate was the possibilities of scaling and the use of scaling laws. To establish scaling laws and to be able to predict the behaviour of a full scale fire, tests ought to be performed in the scales 1:10 and 1:4. The layout of a fire test hall is given. The floor area of this hall is 17 m x 36 m, and the maximum height is 25 m. The test hall is also planned for simulating air stream exposure to the fire area. It ought to be dimensioned for running a hydrocarbon pool fire of area 2,5 m x 5 m for 30 minutes. The report describes other institutions or laboratories where cooperation exists or may be established. Of main interest related to this project are the other Nordic fire testing laboratories, and other institutions where fire tests may be performed on a very large or full scale.

7212 **(STF—25A82009) Modeling of hydrocarbon fires. Subreport no. 1.** Stensaas, J.P.; Amundsen, J.H. (SINTEF, Trondheim (Norway)). Jan 1983. 68p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE84750123.

The aim of the project is to estimate critical fire load from different types of hydrocarbon fires and the thermal response of constructions, partitions, equipment and materials from small scale laboratory experiments. Further, through experimental surveys in different scales it is the aim to provide a basis of calculation in order to determine how important parameters such as the burning velocity, flame temperatures, flame lengths and radiant and convective heat transfer vary as a function of fuel type, geometry of enclosure and vent openings for hydrocarbon fires in a compartment on an offshore platform. This first subreport gives a brief examination of the theory of fire in enclosures and an up to date review of fire modeling. On the basis of this there has been choosen a modeling/scaling method and a program in order to carry out the experiments. 17 drawings, 1 table.

0207 Marketing And Economics

7213 **(DOE/EIA—0035(83/12)-1) Monthly Energy Review, December 1983 [1]: September 1983 data .** (USDOE Energy Information Administration, Washington, DC. Office of Energy Markets and End Use). 22 Dec 1983. 117p. NTIS, PC A06/MF A01 - GPO. Order Number DE84004263.

Energy production during September 1983 totaled 5.1 quadrillion Btu, a 0.4% increase from the level of production during September 1982. Coal production increased 3.6% and petroleum production was up 0.2%. Natural gas production fell 3.9%. Production of all other forms of energy combined increased 3.5% compared to production 1 year earlier. Energy consumption during September 1983 totaled 5.6 quadrillion Btu, 3.6% above the level of consumption during September 1982. Coal consumption increased 10.9% and petroleum consumption was up 2.5%. Natural gas consumption decreased 1.8%. Consumption of all other forms of energy combined increased 3.8% compared to consumption during September 1982. Net imports of energy during September 1983 totaled 0.8 quadrillion Btu, 25.5% above the level of imports during September 1982. Net imports of petroleum increased 17.0%, while net imports of natural gas decreased 1.6%. Net exports of coal were down 13.7% compared to the level in September 1982.

7214 **(DOE/EIA—0109(83/12[1])) Petroleum supply monthly.** (USDOE Energy Information Administration, Washington, DC). Dec 1983. 81p. NTIS, PC A05/MF A01 - GPO. Order Number DE84004085.

Minimum operating inventory estimates (MOI) are not static but change with those factors influencing the industry structure. Thus, primary inventories for distillate and residual fuel oils have recently fallen substantially below the MOI's established for those fuels in the 1979. That these MOI figures were clearly out of date prompted, the request for revised estimates. Industry conditions influencing MOI's, however, are still in a state of flux. Residual fuel oil MOI's, in particular, continue to respond to decreased economic activity, fuel switching and changing import levels. Accordingly, increasing care should be exercised over time in utilizing the 1983 MOI estimates presented in this article. This revised inventory contains additional information on how the MOI estimates were de-

rived and on how current inventory data can now best be interpreted.

7215 **(NP—3770164) AFM annual report 1981.** (Aussenhandelsverband fuer Mineraloel e.V., Hamburg (Germany, F.R.)). Jul 1982. 33p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83770164.

The mineral oil sales of the F.R. of Germany show a downward movement. A transparency of the market was achieved by registering the oil imports. Precautionary measures (stocks), taxes, customs and foreign trade as well as pollution problems (gas oil-sulphur) are discussed. The report is concluded by statistics.

7216 **(NP—4900396) Economic impacts of increased crude oil production from Texas oil fields. Report 76-11-01.** Holloway, M.L. (Texas Governor's Energy Advisory Council, Austin (USA)). 8 Nov 1976. 6p. NTIS, PC A02/MF A01. Order Number DE84900396.

The importance of increasing our domestic supplies of crude oil to replace expensive, unreliable sources of foreign crude oil is obvious. If additional supplies of crude oil can be produced in the US for near world market prices of $13 per barrel, the drain on the US balance of trade can be decreased and provide increased security from the threat of a new embargo. As shown in this paper, additional supplies of crude oil from domestic sources also provide an additional stimulus to the overall economy, increasing incomes, tax revenues and employment. These opportunities for economic gain should be taken into account when assessing policies which affect the development of additional domestic supplies from secondary and enhanced oil recovery.

0209 Environmental Aspects

REFER ALSO TO CITATION(S) 7223, 8566

7217 **(DOE/EV/10404—T5) Characterization of polynuclear aromatic compounds in petroleum refining localities. Final report, December 1, 1981-August 31, 1982.** Warner, I.M. (Texas A and M Univ., College Station (USA). Dept. of Chemistry). 1982. Contract AS05-80EV10404. 13p. NTIS, PC A02/MF A01. Order Number DE84004118.

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Analytical methods include chromatography, mass spectroscopy, video fluorometry, and combined techniques such as GC/MS and LC/VF. Samples were collected in the Beaumont-Port Arthur, TX area and analyzed by GC/MS after separation. Preliminary results indicate that most of the priority pollutant are at or near blank levels. (DLC)

7218 **(PB—83-250811) Rare, threatened, and endangered vertebrates of southwest Florida and potential OCS (outer continental shelf) activity impacts.** Woolfender, G.E. (University of South Florida, Tampa (USA). Dept. of Biology). Feb 1983. 79p. NTIS, PC A05/MF A01.

The eight southwestern Florida counties include populations of 68 vertebrates considered in this report as rare, threatened, or endangered. The terrestrial and near-shore habitats of the study area and the habitat preferences of each of the 68 vertebrates are described. Each vertebrate is listed in the habitats it occupies, and information about reproduction, feeding, and where available, population estimates, is given under the habitat considered most important for each species. The distributions of the rare, threatened and endangered vertebrates by county and habitat demonstrate the relative importance of the southernmost counties (Monroe and Collier) and wetland and coastal habitats. Activities contributing to the decline of these 68 vertebrates are assessed and habitat loss is overwhelmingly more important for all.

7219 **(USGS-PP—1227) Oilspill risk analysis model of the US Geological Survey.** Smith, R.A.; Slack, J.R.; Wyant, T.; Lanfear, K.J. (Geological Survey, Reston, VA (USA)). 1982. 43p. USGS, 604 S Pickett St., Alexandria, VA 22304.

The US Geological Survey has developed an oilspill risk analysis model to aid in estimating the environmetal hazards of developing oil resources in Outer Continental Shelf (OCS) lease areas. The large, computerized model analyzes the probability of spill occurrence, as well as the likely paths or trajectories of spills in relation to the locations of recreational and biological resources which may be vulnerable. The analytical methodology can easily incorporate estimates of weathering rates, slick dispersion, and possible mitigating effects of cleanup. The probability of spill occurrence is estimated from information on the anticipated level of oil production and method and route of transport. Spill movement is modeled in Monte Carlo fashion with a sample of 500 spills per season, each transported by monthly surface-current vectors and wind velocities sampled from 3-hour wind-transition matrices. Transition matrices are baesd on historic wind records grouped in 41 wind velocity classes, and are constructed seasonally for up to six wind stations. Locations and monthly vulnerabilities of up to 31 categories of environmental resources are digitized within an 800,000 km^2 study area. Model output includes tables of conditional impact probabilities as well as probability distributions for oilspills occurring and contacting environmental resources within preselected vulnerability time horizons. The model provides the US Department of the Interior with a method for realistically assessing oilspill risks associated with OCS development. To date, it has been used in oilspill risk assessments for eight OCS lease sales with the results reported in Federal environmental impact statements. A sumary of results is presented herein. A real time version was also used to forecast the movement of oil from the 1976-1977 Argo Merchant oilspill. Additional model runs are planned for future OCS lease sales in frontier areas. 35 references, 13 figures, 10 tables.

0210 Legislation And Regulation

REFER ALSO TO CITATION(S) 8043

0230 Properties

7220 **(DOE/SF/11562—T1) Emulsion of an in-situ surfactant in petroleum. Final report.** (University of Southern California, Los Angeles (USA)). Dec 1983. Contract AT03-81SF11562. 3p. NTIS, PC A02/MF A01. Order Number DE84003873.

Three emulsifiers were tested for their ability to reduce the viscosity of heavy oils. A reduction of 25% viscosity is achieved using polybutene. A reduction of 50% viscosity is achieved using a concentrated ionic detergent obtained from SANDOZ. The most promising emulsifiers is a lipopeptide. Preliminary studies show this emulsifier reduces the viscosity of heavy oils by as much as 80%. It is also able to reduce the surface tension of water by 35%. This emulsifier is also biodegradable and less toxic than synthetic surfactants. (DMC)

0240 Storage

7221 **(SAND—83-2005) Plan for certification and related activities for the Department of Energy Strategic Petroleum Reserve oil storage caverns.** Goin, K.L. (Sandia National Labs., Albuquerque, NM (USA)). Dec 1983. Contract AC04-76DP00789. 31p. NTIS, PC A03/MF A01. Order Number DE84004136.

In order to comply with state laws, protect the environment, and protect the national investment in oil stored, it is necessary to periodically verify the integrity of the Department of Energy Strategic Petroleum Reserve (DOE/SPR) oil storage caverns. The task of developing plans for cavern certification was a responsibility in Sandia's role of geotechnical support for the SPR program. As an implementation of this task, this report includes a plan and procedures for tests and related activities to evaluate the integrity of the DOE/SPR oil storage caverns. 2 references.

0250 Combustion

REFER ALSO TO CITATION(S) 8277, 8526

03 NATURAL GAS

7222 **(DOE/EIA—0130(83/11)) Natural gas monthly.** (USDOE Energy Information Administration, Washington, DC. Office of Oil and Gas). Nov 1983. 163p. NTIS, PC A08/MF A01 - GPO. Order Number DE84004970.

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Monthly highlights of activities, events, and analyses of interest to public and private sector organizations associated with the natural gas industry are presented. Feature articles for this issue are: Natural Gas Overview for Winter 1983-1984 by Karen A. Kelley; and an Analysis of Natural Gas Sales by John H. Herbert. (PSB)

0302 Geology And Exploration

REFER ALSO TO CITATION(S) 7189, 7191, 8644, 8665

7223 **(CONF-830859—12) Factors that control gas flow in tight sandstone.** Randolph, P.L.; Chowdiah, P. (Institute of Gas Technology, Chicago, IL (USA)). 1983. 24p. IGT, 3424 South State St., Chicago, IL 60616.

From National meeting of the American Institute of Chemical Engineers; Denver, CO, USA (28 Aug 1983).

Portions are illegible in microfiche products.

More than 1100 m (3700 ft) of 0.1 m (4 inch) diameter core were cut from the Mesa Verde Formation penetrated by the first two wells of the DOE Multi-Well Experiment (MWX) in Garfield County, Colorado. Thirty two pieces of sandstone core, each about 0.15 m (0.5 ft) long were selected for analysis in IGT's Computer Operated Rock Analysis Laboratory (CORAL). The stream-bed deposition characteristic of the fluvial environment is characterized by a wide variation of porosity, permeability, and pore volume compressibility. Porosity of paludal samples was higher than coastal samples and pore volume compressibility was lower. The blanket marine sands exhibited a smaller range of porosities and permeabilities than the other three environments, but their pore volume compressibility was as great as the costal samples. Differences in pore volume compressibility correlated with effects of pressure on permeability. The pore openings that limit flow through tight sandstones were more than a factor of 10 smaller than openings observed in published scanning electron microscope pictures of bridging Illite clays common in tight sands.

7224 **Natural gas hydrate deposits: a review of in situ properties.** Pearson, C.F.; Halleck, P.M.; McGuire, P.L.; Hermes, R.; Mathews, M. (Los Alamos National Lab., NM). *Journal of Physical Chemistry;* **87**: No. 21, 4180-4185(13 Oct 1983).

Hydrates of natural gas exist in nature in the Arctic regions and underneath the sea floor. Worldwide reservoir estimates range as high as 10^7 trillion ft^3. Very little information is available about the physical properties of these deposits, thus making difficult their detection by remote geophysical surveys. Reviewed are experimental sonic and resistivity measurements on hydrates, hydrate-bearing sediment, and permafrost. Conclusions indicate that hydrate layers are characterized by anomalously high sonic velocities and resistivities, both of which are functions of the amount of liquid water associated with the hydrates in the rock matrix. An analogy between hydrate-bearing sediments and permafrost is used to propose simple quantitative relationships between liquid water content and the electrical resistivities and sonic velocities of the deposits. Electrical and sonic well-logging data are used to substantiate the basic conclusions of this review. 18 references, 6 figures, 2 tables.

0303 Drilling, Production, And Processing

REFER ALSO TO CITATION(S) 7159, 7210, 8043

7225 **(DOE/MC/20201—T4) Effectiveness of Dow Chemical DB31 and an unknown powder from Peabody for defoaming Stretford solution.** Baetens, E.C. (Frumerman Associates, Inc., Pittsburgh, PA (USA)). 19 Dec 1983. Contract AC21-83MC20201. 6p. NTIS, PC A02/MF A01. Order Number DE84005008.

DB31 is an effective defoaming agent at concentrations below the levels suggested as typical by the manufacturer, viz. less than 5 ppM. The Peabody powder is not effective if in fact it is a defoaming agent. Before DB31 is added to the solution in the Stretford system, more rigorous laboratory testing should be performed. Tests should be performed at air flow rates per cross sectional area corresponding to the absorption column and the sulfur removal column to more precisely determine the optimum concentration to use. Relatively small incremental quantities should be tried in the actual Stretford unit, perhaps .1 lb at a time (.3 ppM). Changes in absorption column performance should be noted and samples taken for retesting in the laboratory for each incremental addition. If defoamer is required to obtain satisfactory performance from the Stretford unit, control of concentration may become a problem. 2 tables.

7226 **(NP—4770030, pp 1009-1022) Gas production from the carboniferous strata by wells from the surface.** Demuth, H. [nd]. (In German). NTIS (US Sales Only), PC A99/MF A01.

In Status report 1982. Geotechnics and deposits. Vol. 2.

In this study the possibility of the technical and economical production of coalification gas from the carboniferous strata by wells from the surface is investigated. The technical and economical evaluation determinants were worked out. The gas reserves and the produceability of the gas presented the main problems. It is demonstrated by the concrete example of the Saar carboniferous strata that the gas content of such residual gas reservoirs is comparable with the largest known gas fields of the world. The development of these reserve potentials is however problematic due to the special way of storing and the low permeability of the carboniferous strata. Principally it seams to be possible to solve the problem of the gas production by fracturing in technical and economical means. However, this statement has to be checked further by future field experiments.

0304 Products And By-products

7227 **The design, development and performance of a Duplex Stirling natural gas liquefier.** Berchowitz, D.M. (Sunpower, Inc., Athens, OH). *Proceedings, Intersociety Energy Conversion Engineering Conference;* **4**: 1784-1789(Sep 1982). (CONF-820814—).

From 17. Intersociety Energy Conversion Engineering conference; Los Angeles, CA, USA (8 Aug 1982).

The idea of using a Duplex Stirling System for natural gas liquefaction has long been considered by Sunpower as an attractive application for Stirling engines. A few years ago an internally funded project was embarked upon to build a small demonstration Duplex Stirling unit. This machine was designed around the Model M-100 engine which was then being produced commercially. The demonstrator machine first ran in 1979 and soon proved to be a stable and reliable performer. A series of three further machines incorporating various improvements and modifications followed at which point it was confidently felt that the design of a large machine of more realistic capacity could be attempted. Work was started in August 1981 on the design and development of a preproduction natural gas liquefier with a capacity of at least 4 l/hr. The design of the larger machine borrows extensively from the experience gained from the small prototype machines. Scaling, computer simulation and optimization are used to refine the design. Presented here is a summary of the design and development of the preproduction machine.

0305 Health And Safety

REFER ALSO TO CITATION(S) 7211, 7212

0306 Marketing And Economics

REFER ALSO TO CITATION(S) 7213, 7216

7228 (DOE/EIA—0131(82)) Natural gas annual, 1982. (USDOE Energy Information Administration, Washington, DC. Office of Oil and Gas). Oct 1983. 95p. NTIS, PC A05/MF A01 - GPO. Order Number DE84004949.

Information on the production, reserves, imports, exports, interstate movements, storage, consumption, and price of natural and supplemental gas to a wide audience including industry, consumers, Government agencies, and educational institutions is presented in a sequence that follows natural and supplemental gas from production to end use. Annual summary data on the quantity and average price of natural gas production at the State and national levels are presented, as well as total gas supply/disposition balances. Data on the quantity and price of natural and supplemental gas consumption are shown for major end-use categories by State from several independent data reporting systems.

7229 (DOE/EIA—0131(83)) Natural Gas Annual, 1982. (USDOE Energy Information Administration, Washington, DC. Office of Oil and Gas). Oct 1983. 93p. NTIS, PC A05/MF A01 - GPO. Order Number DE84004893.

Cumulated information on the production, reserves, imports, exports, interstate movements, storage, consumption, and price of natural and supplemental gas is presented in a sequence that follows natural and supplemental gas from production to end use. Annual summary data on the quantity and average price of natural gas production at the State and national levels are presented, as well as total gas supply/disposition balances. Data on the quantity and price of natural and supplemental gas consumption are shown for major end-use categories by State.

7230 Will gas become available in spot, futures markets. O'Neill, R. (Energy Information Administration, Washington, DC). *Energy User News;* 8: No. 47, 30(21 Nov 1983).

A natural-gas spot market would conceivably operate the same as for crude oil, with 5 to 15% of total supply involved and trends reflected in spot prices. A futures market for gas would operate as a paper market in the same manner as agricultural commodities and metals. Futures market advocates claim it is needed for price discovery, risk management, and speculation. Opponents object to speculators who manipulate the market for large profits, but the process of futures contracts is gaining general acceptance despite the problems associated with delivery. These and other questions arise because gas deregulation introduces the possibility for vertical integration. A gas-storage capability will be essential to a smooth-running futures market. (DCK)

0309 Artificial Stimulation

7231 (CONF-820927—8) Seeking prospects for enhanced gas recovery. Doherty, M.G.; Randolph, P.L. (Society of Petroleum Engineers (AIME), Dallas, TX (USA)). 1982. 8p. SPE, 6200 N. Central Expressway, PO Drawer 64706, Dallas, TX 75206.

From 57. AIME Society of Petroleum Engineers annual technical conference and exhibition; New Orleans, LA, USA (26 Sep 1982).

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As part of the Institute of Gas Technology's (IGT) ongoing research on unconventional natural gas sources, a methodology to locate gas wells that had watered-out under over-pressured conditions was developed and implemented. Each year several trillion cubic feet (Tcf) of gas are produced from reservoirs that are basically geopressured aquifers with large gas caps. As the gas is produced, the gas-water interface moves upward in the sandstone body trapping a portion of gas at the producing reservoir pressure. The methodology for identifying such formations consisted of a computer search of a large data base using a series of screening criteria to select or reject wells. The screening criteria consisted of depth cutoff, minimum production volume, minimum pressure gradient, and minimum water production. Wells chosen by the computer search were further screened manually to seek out those wells that exhibited rapid and large increases in water production with an associated quick decline in gas production indicating possible imbibition trapping of gas in the reservoir. The search was performed in an attempt to characterize the watered-out geopressured gas cap resource. Over 475 wells in the Gulf Coast area of Louisiana and Texas were identified as possible candidates representing an estimated potential of up to about 1 Tcf (2.83×10^{10} m^3) of gas production through enhanced recovery operations. A process to determine the suitability of a watered-out geopressured gas cap reservoir for application of enhanced recovery is outlined. This paper addresses the identification of a potential gas source that is considered an unconventional resource. The methodology developed to identify watered-out geopressured gas cap wells can be utilized in seeking other types of watered-out gas reservoirs with the appropriate changes in the screening criteria. 12 references, 2 figures, 5 tables.

7232 (NP—4770030, pp 983-1008) Stimulation of less permeable deep gas reservoirs. John, P.W. [nd]. (In German). NTIS (US Sales Only), PC A99/MF A01.

In Status report 1982. Geotechnics and deposits. Vol. 2.

The working group 'Stimulation' presents following results in the working fields supports and fracture mechanics: - Development and erection of a test apparatus for standardized support; suitability tests - Development of a new highly stable support material - Development of a support production process (patent application is submitted). - Completion of the new developed 3-point bending apparatus to determine fracture mechanical rock parameters considering the influence of liquids and temperature. - Working results from the investigations with the 3-point bending apparatus. - Planning of an apparatus for rock analyses under triaxial load states.

0310 Legislation And Regulation

REFER ALSO TO CITATION(S) 8043

0330 Properties

7233 (DOE/MC/20013—T3) Laboratory analysis of gas hydrate cores for evaluation of reservoir conditions. Monthly report No. 5, November 1, 1983-November 31, 1983. Holder, G.D. (Holder (G.D.), Pittsburgh, PA (USA)). 1983. Contract AC21-83MC20013. 29p. NTIS, PC A03/MF A01. Order Number DE84005006.

During November work has been focused on two items. These are (a) Analysis of the formation kinetics of synthetic hydrate cores. (b) Analysis of the effect of sediment and heat transfer resistance on the dissociation rate of gas hydrates. The conclusion to be drawn is that dissociation of gas hydrates is severly heat transfer limited after only the shortest periods of time. Even if the conductivities used in this example are not correct, it is clear that the presence of a medium between an injected hot fluid and the hydrate zone must be taken into account in calculating rates at which hydrates will dissociate. 22 references, 4 figures, 4 tables.

0350 Storage

7234 (NP—4770030, pp 1227-1238) Measuring probe for gas caverns. Wierczeyko, E. [nd]. (In German). NTIS (US Sales Only), PC A99/MF A01.

In Status report 1982. Geotechnics and deposits. Vol. 2.

A new laser test head with a higher measuring sensitivity has been constructed expecting to use it beside in compressed air storage caverns also in gas storage caverns at low pressures. The development of the supersonic measuring technique has been continued. Several gas storage caverns could be already surveyed with success. Photographs have a great importance in the monitoring of gas storage caverns. In order to prevent the disturbing contamination of the optics slight modifications were made at an existing

probe. Further improvements are planned. A new photo-test head with rotating camera will be developed for horizontal 360° all around photographs.

04 OIL SHALES AND TAR SANDS

0401 Reserves And Exploration

7235 (NP—4770030, pp 869-898) **Review about the status of the exploration and the prospects to produce heavy oil/bitumen.** Cornelius, C.D. [nd]. (In German). NTIS (US Sales Only), PC A99/MF A01.

In Status report 1982. Geotechnics and deposits. Vol. 2.

In view of the increasing importance of the production of heavy, very heavy and far sand oil for the next 50 years they have been defined and the knowledges about the deposits and production processes have been summarized. The discovered but only incompletely published reserves were tabulated according to the countries and to the 70 largest field groups and also 21 deposits with more than 20 billion tons o.i.p. According to a statistical treatment of the heavy/tar sand oil production processes the production processes were analyzed methodically. It is reported about experiences with the deposits which are typical for each process from the proceedings of the presentations at the 2. International Conference on heavy oils and tar sands which took place from 07.-17.02.1982 in Caracas. From the presentations indications were obtained about the options of the further development of the research and development like the improvement of models for the purpose of optimization of quality changes of the oil, steam mixtures, temperature tolerance of chemicals and optimization of costs.

7236 (USGS/MAP/MF—1410) **Geologic map and oil shale deposits of the Elko West quadrangle, Elko County, Nevada.** Solomon, B.J.; Moore, S.W. (Geological Survey, Reston, VA (USA)). 1982. 20p. US Geological Survey, Box 25286, Federal Center, Denver, CO 80225.

7237 (USGS/MAP/MF—1421) **Geologic map and oil shale deposits of the Elko East quadrangle, Elko County, Nevada.** Solomon, B.J.; Moore, S.W. (Geological Survey, Reston, VA (USA)). 1982. 20p. US Geological Survey, Box 25286, Federal Center, Denver, CO 80225.

0402 Site Geology And Hydrology

REFER ALSO TO CITATION(S) 7236, 7237

0403 Drilling, Fracturing, And Mining

REFER ALSO TO CITATION(S) 8223

0404 Oil Production, Recovery, And Refining

REFER ALSO TO CITATION(S) 7095, 7235, 8205

7238 (NP—4770030, pp 915-926) **Development of decision criteria for the selection of suited heavy oil production processes.** Ghoniem, Y.; Murtada, H. [nd]. (In German). NTIS (US Sales Only), PC A99/MF A01.

In Status report 1982. Geotechnics and deposits. Vol. 2.

The increasing demand of energy makes it necessary to provide the large heavy oil and tar sand oil reserves of the world to cover the energy supply. According to the present state of the art chiefly thermal processes (steam injection and in-situ combustion) are applied for the in-situ exploitation of these deposits. Within this project decision criteria for the application of special process combinations were developed by literature studies and laboratory experiments considering economic parameters. Based on previous evaluations the decision criteria and a decision scheme for potential EDR processes were set up and the use of CO_2/steam mixtures (with and without solvent) was proposed. The testing of this process combination in laboratory scale is pursued within the further work on the project.

7239 (NP—4770030, pp 927-944) **Experiment to produce heavy oil by the use of a modified CO_2/steam mixture in the tar sand deposit Ipiatik East/Canada.** Cornelius, C.D.; Mohtadi, M. [nd]. (In German). NTIS (US Sales Only), PC A99/MF A01.

In Status report 1982. Geotechnics and deposits. Vol. 2.

In the South of the Tera field Athabascoe there is the concession block Ipiatik East with reserves of 14 Giga bbls tar sand oil. In 1981 VEBA OEL AG had acquired a share of 10% of it which has been transferred to DEMINEX on February 23, 1982. Here it is reported about criteria which led to the selection of the project and the conception of the heavy oil production process. The unconsolidated quartz sands are positioned in depths of 400 m at a deposit temperature of 15-20°C. The interpretation of the reports about CO_2 injection projects in similar deposits within the scope of 03E-3223-A enabled setting up models for the viscosity improvement by thermal stimulation and CO_2 solubility. The largest improvements were already attained at low CO_2 partial pressures and saturation values. The optimum for Ipiatik East has to be found out by further investigations. The proposal to inject steam and CO_2 initially into the above, lighter part of the oil zone is justified. Several alternatives to generate a steam-CO_2 mixture are discussed. The combined production of steam and CO_2 from waste gases seams to be economically interesting.

7240 (NP—4770030, pp 945-961) **German/Venezuelan cooperation to utilize heavy oil.** Neef, H.J. [nd]. (In German). NTIS (US Sales Only), PC A99/MF A01.

In Status report 1982. Geotechnics and deposits. Vol. 2.

The joint Venezuelan-German feasibility study of the integrated production and processing of Orinoco heavy oil by involving the energy supply yielded that this integrated system for the heavy oil utilization presents a technically feasable and economically favorable way. It could be demonstrated that the hydrogenating processing have distinct technical and economical advantages with respect to the palet of the yield towards coker processes. The study has initiated an intensive and successful cooperation between Venezuela and Germany on the field of heavy oil utilization.

7241 (NP—4770030, pp 963-981) **Feasibility study about an integrated system of the production and processing of Venezuelan heavy oil.** Behrmann, A.; Waldmann, H. [nd]. (In German). NTIS (US Sales Only), PC A99/MF A01.

In Status report 1982. Geotechnics and deposits. Vol. 2.

It is reported about the partial aspects steam injection, field development, steam generation and distribution of the research project "German/Venezuelan cooperation for the utilization of heavy oil". The main boundary conditions and fundamentals are: - the production process (steam stimulation or steam flooding) determined by the reservoir characteristics influencing the required amounts of steam by a factor of 10; - the upgrading process to work up the vacuum distillate residues; the upgrading residues have to be burned to produce the injection steam; - the natural water source and quality which influences decisively the water work up process and the steam production concept. Technically and economically optimal solutions could be found in the relatively broad study. The specific costs of the injection steam are determined to 60 to 75% by the fuel costs according to the chosen concept. In the second phase of the cooperation individual are treated more intensively and investigated experimentally.

7242 (NP—4770030, pp 1085-1096) **Economic production and utilization of the Posidonian shale of the investigation region Schandelah Phase III.** Frohnert, H. [nd]. (In German). NTIS (US Sales Only), PC A99/MF A01.

In Status report 1982. Geotechnics and deposits. Vol. 2.

The behaviour of the Schandelah oil shale in the hydrogenating low-temperature carbonization has been investigated. The low increase in yield and above all the lower oil yield don't justify the higher technological expenditure. The official permission process for a pilot plant to test a new cyclone carbonization process has been initiated. The investment costs and the economy of a industrial cyclone carbonization plant have been calculated on the basis of preliminary experiments. According to them the oil shale project is at the threshold of the economy.

7243 (NP—4770030, pp 1097-1110) **Experimental plant for the further development of the Lurgi-Ruhrgas process.** Bussmann, A.; Grosse-Heitmeyer, J. [nd]. (In German). NTIS (US Sales Only), PC A99/MF A01.

In Status report 1982. Geotechnics and deposits. Vol. 2.

The LR process and its suitability for the low-temperature carbonization of oil shale and coal to produce oil is described. The erection, the start-up and the resulting changes and supplements of the experimental plant are presented. Oil shale and the products obtained in the LR low-temperature carbonization are characterized by a typical example. Process specific possibilities to desulfurize the exhaust gases are shown.

7244 **(UCID—16986-83-3) Oil Shale Project. Quarterly report, July-September 1983.** Lewis, A.E. (ed.). (Lawrence Livermore National Lab., CA (USA)). Nov 1983. Contract W-7405-ENG-48. 13p. NTIS, PC A02/MF A01. Order Number DE84005137.

The sulfur gas species produced using pyrolysis of oil shale were studied and H_2S had the highest concentration. The effectiveness of adding minerals or inorganic compounds during retorting was measured. Dolomite, $CaCO_3$, and ankerite had little effect on the sulfur gas production. CaO caused H_2S production to be reduced by 1/3 and the iron minerals reduced sulfur gas production by factors from 30 to 100. A method was developed of measuring the organic and inorganic nitrogen contents of oil shales by low-temperature ashing. Inorganic nitrogen (in buddingtonite) remains after ashing removes the organic nitrogen. In order to understand factors that determine the amount and rate of nitric oxide emissions, the effectiveness of spent shale to reduce NO in the gas phase was measured. A process simulation model is being developed for a retort system using spent shale as the heat-carrying medium. Individual particle velocities in the lift pipe are being calculated.

0405 Properties And Composition

7245 **(NP—4900612) Characterization of Devonian oil shales by hydrogen pulse NMR: project report for 1982-1983.** Harrell, J.W. Jr. (Alabama Univ., University (USA). School of Mines and Energy Development). Nov 1983. 40p. NTIS, PC A03/MF A01. Order Number DE84900612.

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Magnetic resonance techniques have been used to characterize eastern and western United States oil shales. The intensity of the hydrogen NMR signal has been found to be correlated linearly with the oil Fischer assay, with separate relationships existing for the eastern and western shales. Temperature-dependent measurements have been made on both eastern and western shales. No variation was found for relaxation times below room temperature but they increased with temperature above room temperature. All relaxation times for eastern shales were nearly the same and showed little change with temperature. By contrast, all relaxation times for western shales exhibited a broad minimum below room temperature and a sharp minimum above room temperature. ESR spin concentration measurements of raw shale samples generally decrease as their Fischer assays increase. For beneficiated samples with varying kerogen concentrations, the spin concentration is proportional to the Fischer assay. The ESR spectra of the eastern shales are of particular interest in that they exhibit several resolvable components characteristic of organic free radicals. G-values and saturation characteristics of the components have been determined. ENDOR signals have also been observed.

7246 **Time-temperature-concentration matrix for induced sediment formation in shale diesel fuel.** Cooney, J.V.; Beal, E.J.; Hazlett, R.N. (Naval Research Lab., Washington, DC). *American Chemical Society, Division of Petroleum Chemistry, Preprints;* **28**: No. 5, 1139-1144(Sep 1983). (CONF-830814—Vol.2).

From 186. national meeting of the American Chemical Society; Washington, DC, USA (28 Aug 1983).

The present study has concentrated on the lower temperature range (43°, 65°, and 80°C) in an effort to examine the reliability of using such accelerated storage tests as measures of ambient stability. When subjected to storage at 43°C for periods of time ranging from 52 to 179, d, 2,5-dimethylpyrrole (DMP)-doped shale II diesel fuel marine (DFM) formed large amounts of insoluble material. The DMP was added to samples D-1 and D-11, at concentrations of 0, 45, 135, 270 and 450 ppM in nitrogen, vented trials were conducted at 45 and 450 ppM. The deviation between duplicate stress samples was small and indicated good reproducibility for the test procedure. The inherent gum constituted 5 to 10% of the total insolubles. Venting of the flasks did not affect the amount of insoluble material formed. The presence of the antioxidant 2,4-dimethyl-6-t-butylphenol in D-11 was of no consequence. The DMP test matrix at 80°C and 65°C provided results which compared well with those obtained at 43°C. At all temperatures, the amount of total insoluble material formed was directly proportional to the initial of DMP. Nitrogen balance calculations are able to account for all of the DMP (after stress) as either unreacted or incorporated into the sediment produced. (3 figures, 1 table).

7247 **Electrical conductivity of Colorado oil shale to 900°C.** Duba, A. (Lawrence Livermore National Laboratory, University of California, PO Box 808, Livermore, CA 94550). *Fuel;* **62**: No. 8, 966-972(Aug 1983). Contract W-7405-ENG-48.

Electrical conductivity of oil shale from the Anvil Points Mine, Colorado was measured to temperatures >900°C with conductance bridges operating at frequencies from 100 to 100,000 Hz. The conductivity of low, intermediate and high grade oil shales (15, 124, 233 $mlkg^{-1}$, respectively) is dependent on water content up to $\approx$ 100°C. At $\approx$ 120°C, values of conductivity at $\approx 10^{-7}$ S m^{-1} are observed for all grades. A strong, time-dependent, increase in conductivity, beginning at $\approx$ 400°C, marks the loss of light hydrocarbons and the formation of a conductive char. The frequency dependence of conductivity -slightly less than a decade increase in conductivity per decade increase in frequency over the temperature range 100-400°C–vanishes at temperatures near 500°C. At 600-800°C, the conductivity of these oil shales reaches a maximum value which is as much as 10^8 times larger than the conductivity near 250°C.

0407 Health And Safety

7248 **(DOE/ER/60036—T1) Shale worker's pneumoconiosis, associated respiratory ailments and skin tumors - plus ancillary documentation of mining and retorting processes and oil shale characterization (ex-shale workers in Scotland). Mid-project progress report.** Seaton, A. (SEE CODE- 9050430 Institute of Occupational Medicine, Edinburgh (UK)). Nov 1983. Contract AC02-82ER60036. 6p. NTIS, PC A02/MF A01. Order Number DE84003948.

Progress is reported on a study of survivors of Scottish oil shale mines, retorts, and refineries. The prevalence of pneumoconiosis and skin tumors is being determined by occupational histories, dermatology and smoking questionnaires, and x-ray surveys. A control study of workers of a colliery population in northeast England and mineralogical characterization of Scottish and Colorado shales are also being conducted. (ACR)

0409 Waste Research And Management

7249 **(DOE/ER/60121—T1) Environmental chemistry of oil shale development. Technical progress report, January 1-November 30, 1983.** Sievers, R.E. (Cooperative Inst. for Research in Environmental Science, Boulder, CO (USA)). 1983. Contract AC02-83ER60121. 75p. NTIS, PC A04/MF A01. Order Number DE84004081.

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Topics covered include: pollutant release mechanisms, the interaction of oil shale-related leachates, microbial trace metal mobilization in plant-soil-spent shale systems, effects of retort water and co-disposal on air and water quality, trace elements in plant materials from the CSU intensive study site as interpreted by analysis of variance and pattern recognition techniques, and analytical methods development and pattern recognition research.

7250 **(DOE/LC/10678—2) Physical-chemical treatment of tar sand processing wastewater. Task No. 2. Sludge management studies. Final report.** King, P.H. (Arizona Univ., Tucson (USA). Dept. of Civil Engineering and Engineering Mechanics). Apr 1983. Contract AS20-81LC10678. 53p. NTIS, PC A04/MF A01. Order Number DE84003226.

Previously reported studies indicated the viability of ferric chloride coagulation as a major step in effective treatment of a steam flooding tar sand processing wastewater. The present task involved production of substantial quantities of sludge resulting from ferric chloride coagulation, characterization of the resulting sludge, and the assessment of selected chemical conditioning and dewatering techniques. Treatment was accomplished in 10 to 20 liter batches. The resulting composite sludge had a pH of 4.1 and a solids content of 1.43% (94.8% volatile). Specific resistance obtained from Buchner funnel tests of the composite sludge varied with the level of vacuum employed indicated a relatively compressible sludge. At a vacuum of 5.0 inches of mercury, a R value of 2.1 x 10^{10} m/kg was observed. The compressibility was 0.95. The raw sludge had good filtration properties and dewatered in an acceptable manner. In order to ascertain potential improvement in dewatering rates, conditioning studies were conducted. A sample of sludge was frozen, then thawed to room temperature. The R value was reduced by a factor of thirty. An alternative process added small quantities of polymer. Seven polymers were tested (four cationic, two anionic and one non-ionic). For liquid polymers, the minimum R value was obtained for dosages of 40 to 80 ppM while for powders a dosage of 10 ppM was sufficient. Reductions of up to one order of magnitude were typical at optimum dosage. For small dosages (e.g. 5 ppM) reductions of 30 to 100% were common. Four sand bed filters were utilized to test gravity drainage and air drying characteristics of unconditioned sludge and sludges conditioned with 5 ppM of three selected polymers. Unconditioned sludge showed a tendency for early breakthrough of substantial solids. All of the polymers tested prevented this break-through.

0410 Enviromental Aspects

REFER ALSO TO CITATION(S) 7249, 8565

05 NUCLEAR FUELS

REFER ALSO TO CITATION(S) 7474

0502 Exploration

7251 **Operation and life of the zetatron: A small neutron generator for borehole logging.** Shope, L.A.; Barnaby, B.E.; Berg, R.S.; O'Neal, M.L. (Sandia Nat'l Laboratories, Albuquerque, New Mexico 87185). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-28: No. 2, 1696-1999(Apr 1981). (CONF-801111—).

From 6. conference on application of accelerators in research and industry; Denton, TX, USA (3 Nov 1980).

The zetatron is a small sealed-off D-T accelerator being used for pulsed neutron production in Uranium borehole logging experiments. The tube utilizes a zirconium gas reservoir, Penning type ion source, and up to 130 kV ion extraction with ion beam focussing and secondary electron supression. The mixed D-T beam is incident on a scandium film target and produces in the pulse mode up to 8 X 10^8 neutrons/sec peak rate at a source current of 2.5 A and target voltage of 130 kV. In the borehole logging application the tube, operating at 100 pps, dissipates an average power of about 10 watts. Life testing has demonstrated an average tube functional life of 148 hours and a shelf life in excess of one year. Life limitations include a steady degradation in neutron output of about 50% in 100 hours and eventual tube puncture fractures that are catastrophic.

0504 Feed Processing

REFER ALSO TO CITATION(S) 7311

0505 Enrichment

REFER ALSO TO CITATION(S) 8229, 8271

7252 **(K/TS—11,232) Remote thermometry of moving surfaces by laser-induced fluorescence of surface-bonded phosphor.** Cates, M.R.; Allison, S.W.; Franks, L.A.; Nelson, M.A.; Davies, T.J.; Noel, B.W. (Oak Ridge Gaseous Diffusion Plant, TN (USA); EG and G, Inc., Goleta, CA (USA); Los Alamos National Lab., NM (USA)). Nov 1983. Contract W-7405-ENG-26. 25p. (CONF-831195—5). NTIS, PC A02/MF A01. Order Number DE84004264.

From International congress on applications of lasers and electro-optics; Los Angeles, CA, USA (14 Nov 1983).

Surface temperature of a rotating flywheel is measured remotely by inducing fluorescence from a pulsed nitrogen laser in lanthanum oxysulfide adhered to the surface. 4 references, 11 figures.

0507 Fuels Production And Properties

REFER ALSO TO CITATION(S) 7262, 7482, 8020, 8217

7253 **(HEDL-SA—2903-FP) SAF line pellet gaging.** Jedlovec, D.R.; Bowen W.W.; Brown, R.L. (Hanford Engineering Development Lab., Richland, WA (USA); General Electric Co., Pleasanton, CA (USA)). Oct 1983. Contract AC06-76FF02170. 5p. (CONF-831047—122). NTIS, PC A02/MF A01. Order Number DE84003857.

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

Automated and remotely controlled pellet inspection operations will be utilized in the Secure Automated Fabrication (SAF) line. A prototypic pellet gage was designed and tested to verify conformance to the functions and requirements for measurement of diameter, surface flaws and weight-per-unit length.

7254 **(HEDL-SA—2906-FP) Sintering boat transport system for the SAF line.** Egli, W.; Bogart, R.L. (GA Technologies, Inc., San Diego, CA (USA); Hanford Engineering Development Lab., Richland, WA (USA)). Oct 1983. Contract AC06-76FF02170. 6p. (CONF-831047—121). NTIS, PC A02/MF A01. Order Number DE84003889.

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

The Secure Automated Fabrication (SAF) line will be a remotely operated process for the manufacture of breeder reactor fuel pins. The sintering boat transport system will service the pellet operations. Since the Boat Transport System will be the major link between several subsystem operations, reliability and ease of maintenance are prime requirements for the design. A prototypic version of the Boat Transport System was designed, built and tested to verify the operability of the selected approach. Extensive testing provided valuable input to the final design and substantiated the soundness of the concept.

0508 Spent Fuels Reprocessing

REFER ALSO TO CITATION(S) 7275, 7300

7255 **(CEA-R—5196) Study of ruthenium complexation by 2,2' bipyridine in nitric aqueous solutions.** Alozy, J.P. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France); Ecole Centrale des Arts et Manufactures, 92 - Chatenay-Malabry (France)). 1982. 205p. (In French). NTIS (US Sales Only), PC A10/MF A01. Order Number DE83704106.

Substitution of the NO_3^-, NO^+ ions of RuNO(NO3)x.yH2Osup((3-x)+) complexes by 2,2'bipyridine (bipy) in nitric aqueous solution was studied by spectrophotometry. In the absence of reducing agent we observe the species RuNO(bipy)(NO3)sub(z)sup((3-z)+) and $RuNO(bipy)_2NO_3^{2+}$. Most reducing agents give rise to the $RuNO(bipy)_2NO_3^{2+} + e \rightarrow RuNO(bipy)_2NO_3^+$ reaction. The oxidation potential of the reversible couple $RuNO(bipy)_2NO_3^{2+}/RuNO(bipy)_2NO_3^+$ was measured by cyclic voltamperometry at the platinum electrode. Its value is + 1.02 V/NHE. Substitution of NO^+ ions by a (bipy) molecule is only possible in the presence of reducing agents of apparent formal potential below + 0.5 V/NHE, and anti-nitrite agents are also needed; these two functions can be fulfilled by hydrazine and ascorbic acid. The presence of HSO_3 NH_2 was necessary to obtain the substitution of NO^+ and NO_3^- by bipy during electrochemical reductions. The intermediate complexes $RuNO(bipy)_2NO_3^{2+}$ and $RuNO(bipy)_2NO_3^+$ probably include two bipy molecules in the trans position whereas $RuNO(bipy)_3^{2+}$ complexes, where the sixth coordination position is occupied by π donors stronger than NO_3^-, have two bipy molecules in the cis position.

7256 **(DP—1656) Plutonium-uranium separation in the Purex process using mixtures of hydroxylamine nitrate and ferrous sulfamate.** McKibben, J.M.; Chostner, D.F.; Orebaugh, E.G. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). Nov 1983. Contract AC09-76SR00001. 28p. NTIS, PC A03/MF A01. Order Number DE84004298.

Laboratory studies, followed by plant operation, established that a mixture of hydroxylamine nitrate (HAN) and ferrous sulfamate (FS) is superior to FS used alone as a reductant for plutonium in the Purex first cycle. FS usage has been reduced by about 70% (from 0.12 to 0.04M) compared to the pre-1978 period. This reduced the volume of neutralized waste due to FS by 194 liters/metric ton of uranium (MTU) processed. The new flowsheet also gives lower plutonium losses to waste and at least comparable fission product decontamination. To achieve satisfactory performance at this low concentration of FS, the acidity in the 1B mixer-settler was reduced by using a split-scrub - a low acid scrub in stage one and a higher acid scrub in stage three - to remove acid from the solvent exiting the 1A centrifugal contactor. 8 references, 14 figures, 1 table.

7257 **(K/OP—299-Pt.2) Evaluation of nuclear fuel reprocessing strategies. 2. LWR fuel storage, recycle economics and plutonium logistics.** Prince, B.E.; Hadley, S.W. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). 27 Oct 1983. Contract W-7405-ENG-26. 87p. NTIS, PC A05/MF A01. Order Number DE84004906.

This is the second of a two-part report intended as a critical review of certain issues involved with closing the Light Water Reactor (LWR) fuel cycle and establishing the basis for future transition to commercial breeder applications. The report is divided into four main sections consisting of (1) a review of the status of the LWR spent fuel management and storage problem; (2) an analysis of the economic incentives for instituting reprocessing and recycle in LWRs; (3) an analysis of the time-dependent aspects of plutonium economic value particularly as related to the LWR-breeder transition; and (4) an analysis of the time-dependent aspects of plutonium requirements and supply relative to this transition.

7258 **Current status and directions for fast reactor reprocessing.** Burch, W.D. (Oak Ridge National Laboratory, Oak Ridge, TN). *Proceedings, Intersociety Energy Conversion Engineering Conference;* 1: 13-18(Aug 1983). (CONF-830812—). Contract W-7405-ENG-26.

From 18. intersociety energy conversion engineering conference; Orlando, FL, USA (21 Aug 1983).

The development of fast breeder reactors (FBRs) for commercial electric power production has been under way in several countries for more than 20 years. In the United States (US), as elsewhere, early work was focused on small reactors to prove the feasibility of concepts and later was followed by larger reactors to test engineering features and to develop fuel technology. Because of the perceived crisis in electrical generation expected late in this century, major efforts (including fuel cycle activities) were developed in the early 1970s to ensure the capability of developing and using this new form of nuclear power. However, because of the effects of the oil price rise and subsequent emphasis on conservation, and a slowdown of industrial growth, there has been a decline in such activities, particularly in the US, which was at one time (1970s) the world leader in reactor development. This paper provides a brief history of breeder reprocessing and describes the current status, with emphasis on US programs and glimpses into the future.

7259 **(DP-tr—54) Efficacy of ammonium carbonate and ammonia solutions in tributylphosphate solvent clean-up.** Brodda, B.G.; Merz, E. Translated from *Atomkernenergie/Kerntechnik ;* 43: No. 2, 114-116(1983). Contract AC09-76SR00001. 6p. NTIS, PC A02/MF A01. Order Number DE84003960. DE84003960

Purification of the extractant tri-n-butylphosphate used in Purex reprocessing from radiolytically and hydrolytically formed degradation products di- and monobutylphosphate is usually performed by alkaline scrubbing with Na_2CO_3 and NaOH. This procedure produces salt-containing waste in amounts of 100 to 150 kg $NaNO_3$ per ton of uranium. It is proposed to reduce this quantity drastically by application of $(NH_4)_2CO_3$ instead of Na_2CO_3. Bench scale experiments proved a reduction of solid residues to less than 10% as compared with the conventional technique.

0509 Transport And Storage

REFER ALSO TO CITATION(S) 7270, 7271

7260 **(ANSI/ANS—57.2-1983) American National Standard: design requirements for light water reactor spent fuel storage facilities at nuclear power plants.** (American Nuclear Society, La Grange Park, IL). 7 Oct 1983. 33p. American Nuclear Society, 555 North Kensington Ave., La Grange Park, IL 60525 $35.00.

This standard presents necessary design requirements for facilities at nuclear power plants for the storage and preparation for shipment of spent fuel from light-water moderated and cooled nuclear power stations. It contains requirements for the design of fuel storage pool; fuel storage racks; pool makeup, instrumentation and cleanup systems; pool structure and integrity; radiation shielding; residual heat removal; ventilation, filtration and radiation monitoring systems; shipping cask handling and decontamination; building structure and integrity; and fire protection and communication.

7261 **(DOE/ET/34014—10) Extended Fuel Burnup Demonstration Program.** Schreiber, R.A. (Nuclear Assurance Corp., Atlanta, GA (USA)). Sep 1983. Contract AC02-79ET34014. 188p. (NAC-C—8327). NTIS (US Sales Only), PC A09/MF A01. Order Number DE84002084.

Four cask designs were evaluated to determine the transportability of extended burnup fuels. These were the NAC-1 and NLI-1/2, both legal weight truck casks, and the NLI-10/24 and NAC-3K, both multi-element rail casks. Design modifications were also evaluated where increases in the number of assemblies transportable would be obtained or where shorter cool times for the assemblies could be used. Burnup credit was considered as a possible design modification. The results of the evaluations showed that with minor design modifications, all the designs could transport target burnups of 55,000 MWD/MTU PWR fuels and 50,000 MWD/MTU BWR fuels in reasonable cool times except the NAC-3K.

7262 **(PNL-SA—11124) Oxidation of UO_2 at 150 to 350°C.** White, G.D.; Knox, C.A.; Gilbert, E.R.; Johnson, A.B. Jr. (Pacific Northwest Lab., Richland, WA (USA)). Jul 1983. Contract AC06-76RL01830. 25p. (CONF-830897—4). NTIS, PC A02/MF A01. Order Number DE84002473.

From NRC workshop on spent fuel/cladding reactions during dry storage; Gaithersburg, MD, USA (17 Sep 1983).

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Oxidation of UO_2 through breached LWR spent fuel rods during interim storage in air atmospheres is a potential mechanism for degradation of cladding integrity. The temperature-time range

of published data are inadequate to establish long term behavior under dry storage conditions. Consequently, tests are being conducted in the temperature range of 150 to 350°C on unirradiated pellets to evaluate fuel oxidation behavior. The tests have revealed significant-to-minor oxidation at temperatures down to 200°C and no measurable oxidation at 150°C for times up to 3000 hours. Oxidation at 200°C for 2000 hours led to formation of low density particulate U_3O_8 which destroys pellet integrity. Oxidation of UO_2 pellets at 215 and 250°C was signifcantly accelerated by the presence of 1 volume percent NO_2 in the air. NO_2 is a potential constituent of the air, forming by radiolysis in the gamma radiation field associated with spent fuel assemblies. NO_2 reaction with UO_2 pellets leads to accelerated formation of UO_3 and pellet disintegration. 11 references, 15 figures.

7263 **(SAND—83-2592C) Transportation research activities in support of nuclear waste management programs.** Allen, G.C.; Luna, R.E.; Jefferson, R.M.; Wowak, W.E. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 5p. (CONF-831217—2). NTIS, PC A02/MF A01. Order Number DE84004422.

From 5. civilian radioactive waste management information meeting; Washington, DC, USA (12 Dec 1983).

The Transportation Technology Center has been conducting a wide range of technical and non-technical research activities to assure the ability to transport radioactive materials in a safe, reliable, and publicly acceptable manner. These activities include tasks in Information and Intergovernmental issues, Safety Assessment and Environmental Analysis and Technology Development. Until recently, the requirements of defense waste shipments have served as a focal point for development tasks with the expectation that they would serve as a precursor for commercial activities. The passage of the Nuclear Waste Policy Act has placed additional responsibility on DOE for concerns involving the shipments of civilian materials. The development of additional research responsibilities is expected to proceed concurrently with the evolution of the transportation mission plan for civilian spent fuel and high-level wastes.

0510 Marketing And Economics

REFER ALSO TO CITATION(S) 7257, 7288

0520 Waste Management

REFER ALSO TO CITATION(S) 7305, 7306, 7307, 7308, 7309, 8174, 8196, 8259, 8598, 8641, 8664, 8709

7264 **(BMI/ONWI—519-Draft) Response report from US Department of Energy hearings on proposed salt site nominations.** (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). Nov 1983. Contract AC02-83CH10140. 187p. NTIS, PC A09/MF A01. Order Number DE84003221.

As required by the Nuclear Waste Policy Act (US Congress, 1983, Pub. L. 97-425, Section 112(b)(2)), the US Department of Energy (DOE) conducted a series of nine formal public hearings during April and May 1983, in Louisiana, Mississippi, Texas, and Utah and in the state capitals of Mississippi, Texas, and Utah. The hearings were held in local communities in the vicinity of sites identified as potentially suitable for further study in the program to select a site for the nation's first repository for high-level nuclear waste. The public hearings for potential sites in salt focused on the proposed nomination of the Vacherie salt dome site in Louisiana; the Richton and Cypress Creek salt dome sites in Mississippi; the Deaf Smith County and Swisher County bedded salt sites in Texas; and the Davis and Lavender Canyon bedded salt sites in Utah. The oral and written comments made during the course of the nine formal public hearings were analyzed, paraphrased into almost 1100 comments, and grouped into 62 issues or subjects within the following nine major topical areas: National Waste Terminal Storage program Planning Process, Consultation and Cooperation, Engineering/Repository Design, Geology, Hydrology, Transportation, Public Health and Safety, Environmental Quality, and Socioeconomics. This document provides general responses to each of the 62 major issues raised during the hearings.

7265 **(BMI/ONWI—5001) Petrographic report on clay-rich samples from Permian Unit 4 salt, G. Friemel No. 1 well, Palo Duro Basin, Deaf Smith County, Texas: unanalyzed data.** Fukui, L.M. (Bendix Field Engineering Corp., Grand Junction, CO (USA)). Sep 1983. Contract AC02-83CH10140. 42p. NTIS, PC A03/MF A01. Order Number DE84005109.

This report presents the results of mineralogic and petrographic analyses performed on five samples of clay-rich rock from salt-bearing Permian strata sampled by drill core from G. Friemel No. 1 Well, Deaf Smith County, Texas. Five samples of clay-rich rock from depths of about 2457, 2458, 2521, 2548, and 2568 feet were analyzed to determine the amounts of soluble phase (halite) and the amounts and mineralogy of the insoluble phases. The amounts of halite found were 59, 79, 47, 40, and 4 weight percent, respectively, for the samples. The insoluble minerals are predominately clay (20 to 60 volume percent) and anhydrite (up to 17 volume percent), with minor (about 1.0%) and trace amounts of quartz, dolomite, muscovite, and gypsum. The clays include illite, chlorite, and interstratified chlorite-smectite. The results presented in this petrographic report are descriptive, uninterpreted data. 2 references, 7 tables.

7266 **(BNL-NUREG—33990) Waste package reliability analysis.** Pescatore, C.; Sastre, C. (Brookhaven National Lab., Upton, NY (USA)). 1983. Contract AC02-76CH00016. 7p. (CONF-831174—50). NTIS, PC A02/MF A01 - GPO. Order Number DE84004736.

From Materials Research Society annual meeting; Boston, MA, USA (14 Nov 1983).

Proof of future performance of a complex system such as a high-level nuclear waste package over a period of hundreds to thousands of years cannot be had in the ordinary sense of the word. The general method of probabilistic reliability analysis could provide an acceptable framework to identify, organize, and convey the information necessary to satisfy the criterion of reasonable assurance of waste package performance according to the regulatory requirements set forth in 10 CFR 60. General principles which may be used to evaluate the qualitative and quantitative reliability of a waste package design are indicated and illustrated with a sample calculation of a repository concept in basalt. 8 references, 1 table.

7267 **(CEA-CONF—6641) Instance of quality control operations on a nuclear reactor waste package.** Nouguier, H.; Nomine, J.C.; Vaunois, P. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Mar 1983. 5p. (CONF-830205—36). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704188.

From Waste management conference; Tucson, AZ, USA (27 Feb 1983).

In this paper we discuss an action achieved in 1982 by ANDRA with the assistance of the technical units of the CEA on low and intermediate level waste packages produced by industrial equipment in an EDF nuclear power plant. We describe: the dismantling and sampling methods brought into operation; the means used; and the specific characteristics controlled and the first results obtained.

7268 **(CEA-CONF—6719) Use of ultrasonic seals for surveillance in containers storage. Description of a feasibility demonstration experiment.** Denis, R.; Crutzen, S.; Guay, P.; Beaubron, A.; Schaal, A.; Garie, T. (CEA Centre d'Etudes de Valduc, 21 - Is-sur-Tille (France)). Apr 1983. 6p. (In French). (CONF-830423—14). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750240.

From 5. symposium on safeguards and nuclear material management; Versailles, France (19 Apr 1983).

The feasability of the surveillance of a multi container storage by the use of ultrasonic seals is studied. The principle is based on the strong change of the ultrasonic signal due to the breaking of the seals. The system must be able to detect a non-authorised opening of container and to identify the concerned container. The results of experience bearing on a sixteeen container device are published. They are sufficient to demonstrate the feasibility of that system for a several hundred container storage.

7269 **(DOE/NE—0025/2) Uranium Mill Tailings Remedial Action Program. Annual status report.** (USDOE Assistant Secretary for Nuclear Energy, Washington, DC. Office of Terminal Waste Disposal and Remedial Action). Dec 1983. 27p. NTIS, PC A03/MF A01. Order Number DE84004993.

The FY 1983 project accomplishments are: completed the Remedial Action Plan and Phase I engineering design for the Canonsburg processing site; completed remedial action on an additional 52 vicinity properties and the inclusion of an additional 303 properties in the Uranium Mill Tailings Remedial Action Project; executed cooperative agreements with four states and the Navajo Nation; published the draft environmental impact statement for Salt Lake City site; and issued the approved Project Plan.

7270 **(DOE/NV/10250—11) Commercial Nuclear Waste Research and Development Program. Quarterly report, July-September 1983.** Hakl, A.R. (Westinghouse Electric Corp., Mercury, NV (USA). Waste Technology Services Div.). Oct 1983. Contract AC08-82NV10250. 32p. NTIS, PC A03/MF A01. Order Number DE84004256.

This document is a report of activities during the fourth quarter of Fiscal Year 1983 to meet task objectives of the NNWSI FY-1983 Project Plan. Noteworthy accomplishments were: a detailed inspection was performed, by remote operation, on fuel assembly D15 and the canister in which it was encapsulated during the Climax granite facility spent fuel test; the two fuel rods which were removed from fuel assembly B02 prior to its installation into the Fuel Temperature Test were inspected and photographed to document pre-test cladding condition and crud adherence; gas samples were acquired from all of the 17 canisters containing fuel assemblies which are currently located at the E-MAD facility; the Fuel Temperature Test being conducted for the Dry Storage Fuel Integrity Demonstration is in its seventh month; Quality Assurance surveillance and monitoring of NNWSI drilling activities were concluded September 30; all DOE/NV Phase III Quality Assurance training was completed and assessment of DOE/NV divisions' training programs was performed and documented; and a document was prepared, at the request of the Battelle Pacific National Laboratory, which updates previous information regarding existing E-MAD capabilities that meet current requirements for interim storage of from 100 to 300 metric tons of nuclear fuel.

7271 **(DOE/NV/10250—12) Commercial Nuclear Waste Research and Development Program. Annual report, Fiscal Year 1983.** Hakl, A.R. (Westinghouse Electric Corp., Mercury, NV (USA). Waste Technology Services Div.). Oct 1983. Contract AC08-82NV10250. 73p. NTIS, PC A04/MF A01. Order Number DE84004255.

This document is a report of FY 1983 activities performed to meet task objectives of the Nevada Nuclear Waste Storage Investigations (NNWSI) Project Plan. Noteworthy accomplishments were: Canisters containing spent nuclear fuel assemblies were opened and the fuel retrieved. All canistered fuel assemblies which were utilized in the Spent Fuel Test at the Climax Granite Facility at the Nevada Test Site were returned to E-MAD. Detailed examinations were performed on fuel assemblies B02, D06, and D15 and their storage canisters. Fuel rods were removed from fuel assembly B02, visually inspected, and photographed through the Hot Bay periscope. Fuel assembly B02 was installed in the Fuel Temperature Test assembly. All fueled canisters at the E-MAD facility were transported from their storage locations to a Hot Bay work station for acquisition of canister gas samples to assure the continued integrity of the canisterized fuel assemblies. Modifications to the Plasma Arc Weld System improved performance of the welder and quality of the weld to the extent that test specimens, made during hands-on welding operations, met ASME code qualification requirements. Installation of the E-MAD exhaust air stack isokinetic sample nozzles and integration of the air monitoring systems into one computer console were completed. Quality Assurance surveillance/monitoring services were provided for NNWSI drilling activities on Yucca Mountain, one of the sites being considered for storage of nuclear waste. Training and assessment of the DOE/NV weapons programs' quality assurance programs were performed by WTSD-Nevada Operations Quality Assurance at DOE request.

7272 **(EDF—82H406492) Dispersion in a tidal sea.** Warluzel, A.; Benque, J.P. (Electricite de France, 78 - Chatou). 1982. 67p. (In French). NTIS (US Sales Only), PC A04/MF A01. Order Number DE83704189.

This report deals with dispersion in a mean two-dimensional flow such as the sea. A theory is presented leading to the definition of dispersion by a 2 x 2 tensor, the terms of which are expressed as a function of the velocity distribution of the flow in the vertical direction and of the turbulent viscosity coefficient. A pessimistic estimation (too small) of the coefficients of this tensor is obtained by calculating the velocity distribution in the vertical direction for the case of a flat infinite bed and no wind. The vertical turbulent velocity distribution used for this estimation was extracted from the literature. Both the permanent and tidal regime results are presented in the form of a nomograph. The dispersion tensor coefficients were also calculated from field measurements giving the velocity distribution in the vertical direction. These measurements were performed out at sea in the region of the Flammanville plant by the laboratory.

7273 **(EGG-REP—6440) Pilot task analysis of the DOE Size Reduction Facility 243-5Z Plutonium Finishing Plant.** Banks, W.W.; Paramore, B.A. (EG and G Idaho, Inc., Idaho Falls (USA)). 25 Oct 1983. Contract AC07-76ID01570. 175p. NTIS, PC A08/MF A01. Order Number DE84004234.

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This report documents a pilot task analysis of operations in the proposed Size Reduction Facility at Rockwell-Hanford's Plutonium Finishing Plant. The Size Reduction Facility will provide a controlled environment for the cutting and packaging of gloveboxes for long-term storage or burial. The analysis was limited to tasks that will be performed within the boundaries of the Size Reduction Facility and the associated load-out area. Tasks to be performed outside those areas were not analyzed (e.g., tasks of preparing gloveboxes and moving them to the facility). The results of this task analysis effort have produced a first order sequence of procedures and a complete and integrated set of training requirements. The training requirements are broken down into systems, academic, and administrative knowledge necessary for task execution. In addition, all items of support equipment necessary to perform the process functions of the size reduction facility have been documented. Risk profiles are provided to advise management on the potential for performance errors and to indicate where future resources should be focused to minimize hazards in the work environment. Other data are available in this report to support the development of operating procedures and an integrated performance-based training program.

7274 **(ENICO—1116) ICPP effluent monitoring report, 3rd quarter CY-1983. Supplement 1.** (Exxon Nuclear Idaho Co., Inc., Idaho Falls (USA)). Nov 1983. Contract AC07-79ID01675. 56p. NTIS, PC A04/MF A01. Order Number DE84004891.

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This report summarizes the data collected for effluent and environmental monitoring programs conducted at ICPP by the Effluent Monitoring and Environmental Sciences (EM and ES) Subsection. The period covered by this report is from June 20, 1983 through September 19, 1983. During the 3rd quarter of 1983, 261 curies of activity were disposed of from ICPP operations. Airborne effluent releases to the atmosphere contributed 233 curies; liquid effluent releases through the disposal well contributed 28 curies; and solid waste shipped to the Radioactive Waste Management Complex (RWMC) contained 0.2 curies. 29 figures, 7 tables.

7275 **(INIS-mf—8194) Will the waste management problem force us to do without nuclear power.** Schueller, W. (Wiederaufarbeitungsanlage Karlsruhe Betriebsgesellschaft m.b.H., Eggenstein-Leopoldshafen (Germany, F.R.)). [nd]. 22p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83703962.

The technical principles and the energy-political importance of the reprocessing of nuclear fuels are explained and the state of the art and safety during operation of such facilities are considered

in details. Some safety aspects of reprocessing especially in comparison with nuclear power plants are dealt with. Finally the present situation of nuclear waste management is discussed and the author is expressing his opinion on the title question.

7276 **(INIS-mf—8226) How long must radioactive wastes from the nuclear fuel cycle be excluded from the biosphere. Considerations on the toxicity of radioactive waste.** Steffen, G. (Bremen Univ. (Germany, F.R.)). Jul 1982. 34p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83703963.

Estimations of the social costs resulting from the generation and release of radionuclides in the nuclear fuel cycle on the basis of the "potential hazard measure" prove, without any additional hypotheses, costs too high as to be acceptable under social aspects. Other approaches to a comparison between advantages and disadvantages determine only part of the radioactivity or use equally unproven additional assumptions. The nuclear industry, but also representatives of supervisory authorities and research institutes argue on the basis of radiotoxicity calculations that even high-level radioactive wastes will cease to be an unbearable risk after several hundreds or thousands of years. In this connection no standardized measure of toxicity is used, nor is there any convincing reasoning agreed upon, so that the estimates of the moment when the high-level radioactive wastes can be considered harmless differ from 500 to 100000 years. An exact application of the various concepts of toxicity and a careful argumentation show, however that detailed safety considerations on an ultimate storage for radioactive wastes of the nuclear fuel cycle should also be made for long periods of times in the geological sense.

7277 **(INIS-mf—8277) Time-table of important events in connection with radioactive waste disposal.** (Deutsche Gesellschaft fuer Wiederaufarbeitung von Kernbrennstoffen m.b.H. (DWK), Hannover (Germany, F.R.)). Jul 1982. 22p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704767.

This data compilation is a small manual in connection with the radioactive waste disposal of German nuclear power plants. The record begins December 12, 1951, when electric power from nuclear energy was first generated in the Arco Reactor in Idaho/USA, and is continued till July 20, 1982, when the government of the Land Hessen confirmed a previous decision selecting Wangershausen as the site for a projected reprocessing plant.

7278 **(INIS-mf—8281) Alternative waste form for the final disposal of high-level radioactive waste (HLW) on the basis of a survey of solidification and final disposal of HLW.** Bauer, C. (Karlsruhe Univ. (T.H.) (Germany, F.R.). Fakultaet fuer Maschinenbau; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.)). 21 Oct 1982. 260p. (In German). NTIS (US Sales Only), PC A12/MF A01. Order Number DE83704765.

The dissertation comprises two separate parts. The first part presents the basic conditions and concepts of the process leading to the development of a waste form, such as:origin, composition and characteristics of the high-level radioactive waste; evaluation of the methods available for the final disposal of radioactive waste, especially the disposal in a geological formation, including the resulting consequences for the conditions of state in the surroundings of the waste package; essential option for the conception of a waste form and presentation of the waste forms developed and examined on an international level up to now. The second part describes the production of a waste form on TiO_2 basis, in which calcined radioactive waste particles in the submillimeter range are embedded in a rutile matrix. That waste form is produced by uniaxial pressure sintering in the temperature range of 1223 K to 1423 K and pressures between 5 MPa and 20 MPa. Microstructure, mechanical properties and leaching rates of the waste form are presented. Moreover, a method is explained allowing compacting of the rutile matrix and also integration of a wasteless overpack of titanium or TiO_2 into the waste form.

7279 **(INIS-mf—8573) Special waste disposal in Austria - cost benefit analysis.** Kuntscher, H. (Bundesministerium fuer Gesundheit und Umweltschutz, Vienna (Austria)). 1983. 261p. (In German). NTIS (US Sales Only), PC A12/MF A01. Order Number DE83704191.

The present situation of special waste disposal in Austria is summarized for radioactive and nonradioactive wastes. A cost benefit analysis for regular collection, transport and disposal of industrial wastes, especially chemical wastes is given and the cost burden for the industry is calculated.

7280 (INIS-mf—8649, pp 65-98) **Waste processing.** Vons, L.H. (Stichting Energieonderzoek Centrum Nederland, Petten). 1982. (In Dutch). NTIS (US Sales Only), PC A08/MF A01. (CONF-8205225—).

From Conference on nuclear energy - what do you know about it; Enschede, Netherlands (11 May 1982).

The author gives in a simple and clearly written Dutch text an overview of a number of methods for processing radioactive waste from a nuclear reactor and other sources and its definite storage. Firstly, the types and quantities of solid radioactive waste are characterised. Then the dumping of waste in the sea is considered - which waste types may be dumped and under what conditions. Temporary storage systems are then discussed followed by permanent storage systems, including that of fissionable waste in rock-salt formations.

7281 **(NUREG/CR—2813) Development of low-level waste form criteria testing of low-level waste forms.** Davis, R.E.; Gause, E.P. (Brookhaven National Lab., Upton, NY (USA)). Nov 1983. Contract AC02-76CH00016. 25p. (BNL-NUREG—51556). NTIS, PC A02/MF A01 - GPO $3.50. Order Number DE84004563.

The purpose of this report is to recommend a minimum set of short-term standardized tests that should be performed in qualification of a proposed low-level waste solidification matrix. Tests and test parameters for mechanical stability, temperature cycling stability, leachability, and solidification testing with respect to free liquid are considered. 29 references.

7282 **(NUREG/CR—2937) Repository site data report for Tuff: Yucca Mountain, Nevada.** Guzowski, R.V.; Nimick, F.B.; Siegel, M.D.; Finley, N.C. (Sandia National Labs., Albuquerque, NM (USA)). Oct 1983. Contract AC04-76DP00789. 327p. (SAND—82-2105). NTIS, PC A15/MF A01 - GPO $7.50. Order Number DE84004275.

As part of the US Nuclear Regulatory Commission (NRC) risk assessment methodology development programs for high-level nuclear waste disposal, repository site data reports are being prepared on each of the potential geologic media considered by the US Department of Energy (DOE). This report on Yucca Mountain at the Nevada Test Site (NTS) represents one part of this program and is based primarily on published site data. Where necessary, additional data from other parts of NTS or other tuff areas were used. The site consists of a thick sequence of tuff that overlies a Paleozoic, primarily carbonate, basement complex. North- to northeast-trending normal faults are the dominant structural features near the site. Within the tuff sequence, ground-water flow integrates systems from several drainage basins, while in the carbonate rocks, flow is regional in nature. At this time, only speculation about flow patterns is possible due to insufficient data. The tuff units usually contain sodium-potassium-bicarbonate water (pH range: 6.9 to 7.4). Redox potential is unknown at present. The high retardation potential of the tuffs is controlled primarily by the presence of zeolites and smectites. Because of the many rock types encompassed by the term tuff, values of thermomechanical properties also have a wide range.

7283 **(NUREG/CR—3129) Repository site data and information in bedded salt: Palo Duro Basin, Texas.** Tien, P.; Nimick, F.B.; Muller, A.B.; Davis, P.A.; Guzowski, R.V.; Duda, L.E.; Hunter, R.L. (Sandia National Labs., Albuquerque, NM (USA)). Nov 1983. Contract AC04-76DP00789. 515p. (SAND—82-2223). NTIS, PC A22/MF A01 - GPO $9.50. Order Number DE84004280.

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This report is a compilation of data from the literature on the Palo Duro Basin. The Palo Duro Basin is a structural basin, about 150 miles long and 80 miles wide, that is a part of the much larger Permian Basin. The US Department of Energy is investigating the Palo Duro Basin as a potentially suitable area for the site of a repository for the disposal of high-level radioactive waste. Sediments overlying the Precambrian basement range from about 5000 to about 11,000 ft in thickness and from Cambrian to Holocene in age. The strata in the Palo Duro Basin that are of primary interest to the Department of Energy are the bedded salts of the Permian San Andres Formation. The total thickness of the bedded salts is about 2000 ft. The geology of the Palo Duro Basin is well understood. A great deal of information exists on the properties of salt, although much of the available information was not collected in the Palo Duro Basin. Mineral resources are not currently being exploited from the center of the Palo Duro Basin at depth, although the possibility of exploration for and development of such resources can not be ruled out. The continued existence of salts of Permian age indicates a lack of any large amount of circulating ground water. The hydrology of the pre-Tertiary rocks, however, is currently too poorly understood to carry out detailed, site-specific hydrologic modeling with a high degree of confidence. In general, ground water flows from west to east in the Basin. There is little or no hydraulic connection between aquifers above and below the salt sequences. Potable water is pumped from the Ogallala aquifer. Most of the other aquifers yield only nonpotable water. More extensive hydrological data are needed for detailed future modeling in support of risk assessment for a possible repository for high-level waste in the Palo Duro Basin. 464 references.

7284 **(NUREG/CR—3168) Technical considerations for high integrity containers for the disposal of radioactive ion-exchange resin waste.** Piciulo, P.L. (Brookhaven National Lab., Upton, NY (USA)). Oct 1983. Contract AC02-76CH00016. 110p. (BNL-NUREG—51649). NTIS, PC A06/MF A01 - GPO $6.00. Order Number DE84004222.

Requirements in the proposed regulation 10 CFR Part 61 and the NRC draft Branch Technical Position (BTP) on waste form provide the basis for this report. Attention is aimed at three areas which are specific to high integrity containers (HIC) for the disposal of dewatered ion-exchange resin waste: the characteristics of drainable liquids remaining in a HIC; the rationale for the maximum limit on free liquid in a HIC proposed in 10 CFR Part 61; and the technical justification for the HIC design criteria given in the NRC draft BTP on waste form. Information from 24 operating nuclear power stations is presented on their experience with the use and disposal of dewatered ion-exchange resins. Manufacturers of organic ion-exchange resins and the literature were surveyed for data on the factors effecting the stability of ion-exchange resins. The characteristics of drainable liquids in a HIC of dewatered resins could not be accurately defined because of large variations in water quality and resin waste among the nuclear plants. Vendors of dewatering services to the nuclear industry were contacted regarding dewatering procedures for ion-exchange media. Their comments and dewatering test results found in the literature are used to support the requirement in 10 CFR Part 61 that a HIC filled with dewatered resins contain <1% free water on arrival at the burial site. Technical support is provided for each of the high integrity container design criteria given in the draft BTP on waste form. It is believed that these criteria are reasonable and necessary for the design of a HIC that provides structural stability to resin waste. 46 references, 3 figures, 35 tables.

7285 **(NUREG/CR—3353) Preliminary scenarios for the release of radioactive waste from a hypothetical repository in basalt of the Columbia Plateau.** Hunter, R.L. (Sandia National Labs., Albuquerque, NM (USA)). Oct 1983. Contract AC04-76DP00789. 85p. (SAND—83-1342). NTIS, PC A05/MF A01 - GPO. Order Number DE84004283.

Nine release phenomena - normal flow of water, tectonic disturbance of the fracture network, intersection of a new fault with the repository, glaciation, fluvia erosion, thermomechanical disturbances, subsidence, seal failure, and drilling - give rise to 318 preliminary scenarios for the release of waste from a hypothetical high-level-waste repository in basalt. The scenarios have relative probabilities that range over several orders of magnitude. The relative probabilities provide a means of screening the scenarios for the more limited set to be subjected to consequence analysis. Lack of data and of preliminary modeling, however, lead to great uncertainties in the highly conservative probabilities assigned here. As a result, the recommendations in this report are directed at resolution of the major uncertainties in the relative probabilities of the preliminary scenarios. The resolution of some of the uncertainties should help in the selection of the suite of scenarios for final consequence analysis. 38 references, 22 figures, 18 tables.

7286 **(NUREG/CR—3444-Vol.1) Impact of LWR decontaminations on solidification, waste disposal and associated occupational exposure. Annual report.** Davis, M.S. (Brookhaven National Lab., Upton, NY (USA)). Aug 1983. Contract AC02-76CH00016. 114p. (BNL-NUREG—51699-Vol.1). NTIS, PC A06/MF A01 - GPO. Order Number DE84004224.

This report describes generic and specific aspects of hard and soft chemical decontaminations and considers the radiation and thermal stability of the reagents involved. Disposal options for LWR decontamination wastes are reviewed and advantages and disadvantages related to the options are discussed. Studies indicating the potential impact of these wastes on a shallow land burial ability to retain radionuclides are summarized. Processes being considered for the management of spent ion-exchange resins are reviewed. Problems associated with the state-of-the-art of incineration, pyrolysis, wet air oxidation, acid digestion, and chemical digestion are evaluated. The solidification and disposal of decontamination wastes are considered with respect to criteria given in the Licensing Rule for Land Disposal of Radioactive Waste, 10 CFR 61. These are evaluated with respect to possible solidification in cement, bitumen, and plastics. The various options in mixing decontamination wastes with normal LWR resin waste are discussed with respect to their impacts on occupational exposure. 27 tables.

7287 **(ONWI—479) Selection and durability of seal materials for a bedded salt repository: preliminary studies.** Roy, D.M.; Grutzeck, M.W.; Wakeley, L.D. (Pennsylvania State Univ., University Park (USA). Materials Research Lab.). Nov 1983. Contract AC06-76RL01830;AC02-83CH10140. 180p. NTIS, PC A09/MF A01. Order Number DE84004139.

This report details preliminary results of both experimental and theoretical studies of cementitious seal materials for use in a proposed nuclear waste repository in bedded salt. Effects of changes in bulk composition and environment upon phase stability and physical/mechanical properties have been evaluated for more than 25 formulations. Bonding and interfacial characteristics of the region between host rock and seal material or concrete aggregate and cementitious matrix for selected formulations have been studied. Compatibilities of clays and zeolites in brines typical of the SE New Mexico region have been investigated, and their stabilities reviewed. Results of these studies have led to the conclusion that cementitious materials can be formulated which are compatible with the major rock types in a bedded salt repository environment. Strengths are more than adequate, permeabilities are consistently very low, and elastic moduli generally increase only very slightly with time. Seal formulation guidelines and recommendations for present and future work are presented. 73 references, 25 figures, 61 tables.

7288 **(ORNL/TM—8686) Benefit-cost aspects of long-term isolation of uranium mill tailings.** Van Dyke, J. (Oak Ridge National Lab., TN (USA)). Nov 1983. Contract W-7405-ENG-26. 35p. NTIS, PC A03/MF A01. Order Number DE84004152.

The Uranium Mill Tailings Radiation Control Act of 1978 provides for regulations for control of radon diffusion from uranium mill tailings to protect the public welfare. In developing these regulations, the Office of Nuclear Material Safety and Safeguards of the Nuclear Regulatory Commission has sought to establish the benefits and costs for alternative regulatory criteria. This report provides a perspective on some economic issues associated with long-term radiation effects from disposal of uranium mill tailings. The general problem of developing an economic rationale for regu-

lating this activity is complicated by the very long-term and widespread effects which could result from radon gas diffusion associated with tailings piles. The economic issues are also complex because of the trade-offs between costs of disposal and intangible social values. When intergenerational implications were considered the traditional basis for discounting in a benefit-cost framework was found to shift. The appropriate rate of discount was found to depend on ethical assumptions and expectations about the relative welfare of future generations. 30 references, 1 figure, 2 tables.

7289 **(ORNL/TM—8847) Design and construction of a low-level waste shallow land burial experimental facility.** Boegly, W.J. Jr.; Davis, E.C. (Oak Ridge National Lab., TN (USA)). Nov 1983. Contract W-7405-ENG-26. 36p. NTIS, PC A03/MF A01. Order Number DE84004106.

The Environmental Sciences Division (ESD) of the Oak Ridge National Laboratory (ORNL) has been investigating improved shallow land burial (SLB) practices for disposing of low-level radioactive wastes in humid environments. Two improvements currently being studied are the use of a cement-bentonite grout applied to waste trenches before they are covered and the use of an impermeable Hypalon fabric liner, which completely surrounds the waste in a trench. A field-scale demonstration site, known as the Engineered Test Facility (ETF), has been established for these studies in the complex geologic setting typical of the Oak Ridge area. Design of the ETF was initiated in 1980 for purposes of (1) evaluating the ability of the grouted and lined trench treatments to minimize water contact and concurrent waste leaching, (2) evaluating selected waste disposal site characterization criteria, (3) integrating site characterization data into model development, and (4) validating the ETF site model and using it to predict long-term site performance. A total of nine trenches (six treated and three control) were excavated at the site in June of 1981. Bales of ORNL compacted waste were used to fill the 3m x 3m x 3m trenches, and, after treatment, all trenches were closed (backfilled and covered) according to current practice. Evaluation of the trench treatments is in progress using a series of inorganic and organic tracer tests designed to monitor water movement in three regions of interest: the trenches, the unsaturated zone around the trenches, and the saturated zone below the site. A successful demonstration of reduced waste leaching resulting from either of these two trench modifications described in this design and construction report will have immediate application to larger disposal sites having similar water-related problems. 9 references, 14 figures, 3 tables.

7290 **(ORNL/TM—8866) Conductivity mapping of underground flow channels and moisture anomalies in carbonate terrain using electromagnetic methods.** Pin, F.G.; Ketelle, R.H. (Oak Ridge National Lab., TN (USA)). Nov 1983. Contract W-7405-ENG-26. 22p. NTIS, PC A02/MF A01. Order Number DE84004098.

Electromagnetic methods have been used to measure apparent terrain conductivity in the downstream portion of a watershed in which a waste disposal site is proposed. At that site, the pathways for waste migration in groundwater are controlled by subsurface channels. The identification and mapping of these subsurfaces channels constitutes an important contribution to the site characterization study. The channels are identified using isocurves of measured apparent conductivity. Two upstream channel branches are found to merge into a single downstream channel which constitutes the main drainage path out of the waterahed. Electromagnetic terrain conductivity measurement methods are found to be inexpensive, rapid and efficient tools for subsurface investigations. Their contribution to site characterization studies and pathways analyses is particularly significant in planning of the monitoring program, the hydrogeological testing, and the modeling study. The results reported so far are very promising for use of the methods in several other applications related to the subgrade disposal of waste. 7 references, 5 figures.

7291 **(ORNL/TM—8897) Intermediate-level waste transfer line decommissioning project. Final report.** Walls, A.A.; Tatum, W.G.; Myrick, T.E.; du Mont, S.P. (Oak Ridge National Lab., TN (USA)). Dec 1983. Contract W-7405-ENG-26. 70p. NTIS, PC A04/MF A01. Order Number DE84004100.

The Intermediate-Level Waste (ILW) transfer line at Oak Ridge National Laboratory (ORNL) was an integral part of the liquid radioactive waste disposal system, operating from 1952 until 1975. This line was used to transport ILW from the waste processing facilities in the Bethel Valley area at ORNL to final disposal sites in the adjacent Melton Valley. During the history of pipeline operations, approximately 45 million gallons of liquid waste, containing over 1.5 million curies of mixed fission products, were transferred through the line to waste disposal trenches and to the ORNL hydrofracture facility. Use of the line was discontinued in 1975 when a new, doubly-contained line was installed to service the expanded hydrofracture program. Since 1976, the ILW line has been under the control of the ORNL Surplus Facilities Management Program (SFMP). Due to the presence of contaminated soil at two former leak sites along the line, and the potential for radionuclide migration from that portion of the abandoned line that traverses White Oak Creek and the floodplain, decommissioning of the ILW line was given a high priority by the ORNL SFMP. In 1979, plans were initiated for corrective action along those portions of the line. The decommissioning activities have now been completed, with the abandoned line being placed in a condition that significantly reduces the hazards associated with it. The portion of the line in the White Oak Creek floodplain was removed, and the two leak sites entombed. This report presents the results of the ILW line decommissioning project, outlining the scope of the effort, describing the decommissioning experiences, and summarizing the project costs and schedules. 14 references, 30 figures, 3 tables.

7292 **(RHO-PB-SR—10-B-WM-Nov.83) Rockwell Hanford Operations: defense waste and byproducts management, monthly report, November 1983.** (Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations). Nov 1983. Contract AC06-77RL01030. 82p. NTIS, PC A05/MF A01. Order Number DE84004205.

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Subsequent to review of tank contents by engineering, five single-shell tanks were declared Interim Stabilized in November. The total number of Interim Stabilized Single-Shell tanks is now 66 of 149. With the stabilization of Tank 104-TY, the entire TY Tank Farm is now Interim Stabilized. The National Environmental Policy Act (NEPA) strategy plans were submitted to DOE-Richland. The caustic strike for Campaign 83-2 was completed and 5.0 MCi of purified strontium was produced. Seventeen strontium capsules were produced in November. Phase V decontamination and decommissioning (D an D) of the 204-S Waste Unloading Facility continued to progress well ahead of schedule. All four 50,000-gallon tanks have now been removed and transported to the burial trench. The 204-S D and D is now projected to be completed by December 30, 1983, three months ahead of schedule. One V-type trench was completed bringing the Fiscal Year To Date excavation total to 2.1 million cubic feet. Three capsules from the WESF pool cell were shipped to Oak Ridge National Laboratory for use in fabricating cesium sources. Arrangements are in progress to take advantage of these capsules being emptied at ORNL, and destructive evaluation of inner capsule wall sections will be performed. This analyses will provide data on the corrosion rate of cesium capsules under water basin storage conditions since these capsules have been in water basin storage for 5 to 8 years.

7293 **(SKBF-KBS-TR—82-06) Numerical simulation of double packer tests. Calculation of rock permeability.** Braester, C.; Thunvik, R. (Svensk Kaernbraenslefoersoerjning AB, Stockholm). Jun 1982. 53p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE83704190.

The permeability of a fractured hard rock formation is usually calculated using the recorded overpressure and the rate of flow during a double packer test. Existing formulae assume that the formation is both homogeneous, and isotropic, and the borehole is sealed in the region outside the packers, but in practice these assumptions are not fulfilled. The objective of the present investigation is to check the influence on the calculated rock permeability of inhomogeneities, anisotropy and return of flow from the formation into the unsealed part of the borehole by numerical simulation of double packer tests. For this purpose different formations with known permeabilities were considered.

7294 **(UCRL—89475) Post emplacement environment of waste packages.** Knauss, K.G.; Oversby, V.M.; Wolery, T.J. (Lawrence Livermore National Lab., CA (USA)). 1983. Contract W-7405-ENG-48. 10p. (CONF-831174—57). NTIS, PC A02/MF A01. Order Number DE84004288.

From Materials Research Society annual meeting; Boston, MA, USA (14 Nov 1983).

Experiments have been conducted as part of the Nevada Nuclear Waste Storage Investigations Project to determine the changes in water chemistry due to reaction of the Topopah Spring tuff with natural groundwater at temperatures up to 150°C. The reaction extent has been investigated as a function of rock-to-water ratio, temperature, reaction time, physical state of the samples, and geographic location of the samples within the tuff unit. Results of these experiments will be used to provide information on the water chemistry to be expected if a high-level waste repository were to be constructed in the Topopah Spring tuff. 6 references, 5 figures, 1 table.

7295 **(UCRL—89477) NNWSI waste form testing program.** Oversby, V.M. (Lawrence Livermore National Lab., CA (USA)). Nov 1983. Contract W-7405-ENG-48. 11p. (CONF-831174—59). NTIS, PC A02/MF A01. Order Number DE84004818.

From Materials Research Society annual meeting; Boston, MA, USA (14 Nov 1983).

A waste form testing program has been developed to ensure that the release rate of radionuclides from the engineered barrier system will meet NRC and EPA regulatory requirements. Waste form performance testing will be done under unsaturated, low water availability conditions which represent the expected repository conditions. Testing will also be done under conditions of total immersion of the waste form in repository-type water to cover the possibility that localized portions of the repository might contain standing water. Testing of reprocesses waste forms for CHLW and DHLW will use reaction vessels fabricated from Topopah Spring tuff. Chemical elements which are expected to show the highest release rates in the mildly oxidizing environment of the Topopah Spring tuff horizon at Yucca Mountain are Np and Tc. To determine the effect of residual canister material and of corrosion products from the canister/overpack, waste form testing will be done in the presence of these materials. The release rate of all radionuclides which are subject to NRC and EPA regulations will be measured, and the interactive effects of the released radionuclide and the rock reaction vessels will be determined. The testing program for spent fuel will determine the release rate from bare spent fuel pellets and from Zircaloy clad spent fuel where the cladding contains minor defects. A metal testing program for Zircaloy will establish the expected lifetime of the cladding material. Estimation of the state of cladding for fuel presently in reactor pool storage will provide baseline data for Zircaloy containment credit. 9 references, 4 figures.

7296 **(USGS-OFR—82-863) Hydrology of the low-level radioactive-solid-waste burial site and vicinity near Barnwell, South Carolina.** Cahill, J.M. (Geological Survey, Denver, CO (USA)). 1982. 109p. US Geological Survey, Open-File Services Section, Box 25425, Denver Federal Center, Denver, CO 80225.

Geologic and hydrologic conditions at a burial site for low-level radioactive waste were studied, and migration of leachates from the buried waste into surrounding unconsolidated sediments were evaluated. The burial site and vicinity are underlain by a sequence of unconsolidated sediments of Late Cretaceous, Tertiary, and Quaternary age. These sediments are deposited over a graben which has been filled with sedimentary rocks of Triassic age. Hydraulic properties of the sediments beneath the burial site were determined by laboratory and field tests. Laboratory hydraulic conductivity values ranged from about 10^{-7} to 10^{-1} ft/day for the clayey sediments to nearly 22 ft/day for aquifer sands. Field aquifer tests indicate a transmisivity of about 22,000 ft²/day for Cretaceous sediments and about 6000 ft²/day for Tertiary sediments. Aquifer tests indicate heterogeneity in the upper 200 ft of the Tertiary sediments. Water samples were analyzed from 51 wells, 5 streams, a Caroline bay, and rainfall at the burial site. The total dissolved solids of the ground water ranged from about 7 to 40 mg/l in the upper clayey sediments to about 150 mg/l in the water in the deeper calcareous sediments. The pH of the ground water ranges from 4.8 to 6.5. This slightly acidic water is corrosive to buried metal. Tritium activity greater than background was detected in sediment cores taken from drill holes adjacent to the burial trenches. High tritium activity occurred at depths above the trench floor. This indicates upward movement of water or vapor to the land surface. Tritium and organic constituents greater than background concentrations were observed in a monitoring well about 10 ft from a trench, indicating lateral migration of radionuclides from the buried waste. Traces of ^{60}Co and tritium greater than background activity were observed in sediment cores collected 5.8 ft beneath the trench floor at one site. 26 references.

7297 **Storage depot for radioactive material.** Szulinski, M.J. (to Dept. of Energy). US Patent 4,410,802. 18 Oct 1983. Filed date 15 Apr 1976. vp.

PAT-APPL-677339.

Vertical drilling of cylindrical holes in the soil, and the lining of such holes, provides storage vaults called caissons. A guarded depot is provided with a plurality of such caissons covered by shielded closures preventing radiation from penetrating through any linear gap to the atmosphere. The heat generated by the radioactive material is dissipated through the vertical liner of the well into the adjacent soil and thus to the ground surface so that most of the heat from the radioactive material is dissipated into the atmosphere in a manner involving no significant amount of biologically harmful radiation. The passive cooling of the radioactive material without reliance upon pumps, personnel, or other factor which might fail, constitutes one of the most advantageous features of this system. Moreover this system is resistant to damage from tornadoes or earthquakes. Hermetically sealed containers of radioactive material may be positioned in the caissons. Loading vehicles can travel throughout the depot to permit great flexibility of loading and unloading radioactive materials. Radioactive material can be shifted to a more closely spaced caisson after ageing sufficiently to generate much less heat. The quantity of material stored in a caisson is restricted by the average capacity for heat dissipation of the soil adjacent such caisson.

7298 **Sorption of selected radionuclides on various metal and polymeric materials.** Raber, E.; Garrison, J.; Oversby, V. (Lawrence Livermore National Lab., CA). *Radioactive Waste Management and the Nuclear Fuel Cycle;* 4: No. 1, 41-52(Sep 1983). Contract W-7405-ENG-48.

Twenty-two various polymeric and metallic materials were evaluated for characteristic sorption properties with respect to Selenium-75, Strontium-85 and Cesium-137 in synthetic ground water. These experiments were conducted to determine which materials would not influence sorption measurements and could be used in the design and fabrication of field apparatus to study radionuclide migration in fractured rock. This paper gives the results of static batch (K_a) sorption experiments along with details of the laboratory and analytical procedures. Of the materials tested, zirconium metal, Lucite, urethane, polycarbonate, Viton (E-60C) and fluorohydrocarbon (i.e., Teflon FEP and Teflon TFE) were found to show little or no sorption ($\leq$ .01 ml/cm²) for each of the radionuclides tested. Materials such as Neoprene, steel, Hycar, cold-rolled steel, nitrile and 316-stainless steel showed higher K_a values $\geq$ 1.0 ml/cm² for at least one of the radionuclides. Selenium-75 was found to exhibit the greatest overall sorption tendency. 6 references, 3 figures, 3 tables.

7299 **Nuclear waste repository characterization: a spatial estimation/identification approach.** Candy, J.V.; Mao, N.H. (Lawrence Livermore National Laboratory, Livermore, CA 94550). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Geoscience and Remote Sensing;* GE-21: No. 2, 191-200(Apr 1983).

In this paper the authors consider the application of spatial estimation techniques to groundwater aquifer and geological borehole data. They investigate the adequacy of these techniques to reliably develop contour maps from various data sets. The estimator is developed theoretically in a simplified fashion using vector-matrix calculus. The practice of spatial estimation is discussed and the estimator is then applied to a groundwater aquifer system and a deep geological formation. It is shown that the various statistical models

must first be identified from the data and evaluated before reasonable results can be expected.

7300 **NWK Direkt-Information. (State of nuclear waste management of German nuclear power stations. Nuclear waste management: by no means an unsolved problem).** Hamburg, Germany, F.R.; Nordwestdeutsche Kraftwerke A.G. (1983). vp. (In German). Available from Nordwestdeutsche Kraftwerke A.G., Hamburg (Germany, F.R.).

The waste management of nuclear power plants in the Federal Republic of Germany is today prevailing in the public discussion. Objections raised in this connection, e.g. that the nuclear waste management has been omitted from the development of peaceful utilization of nuclear energy or remained insolved, are frequently accepted without examination, and partly spread as facts. This is, however, not the truth: From the outset in 1955 the development of nuclear technology in the Federal Republic of Germany has included investigations of the problems of reprocessing and non-detrimental disposal of radioactive products, and the results have been compiled in a national nuclear waste management concept. (orig.).

7301 **Inventories and characteristics of Transuranic waste.** Jensen, R.T. (Chemical Systems Engineering, Rockwell International, Rocky Flats Plant, Golden, Colorado). *Nuclear and Chemical Waste Management;* 4: No. 1, 19-24(1983).

This report summarizes the available data on inventories and characteristics of transuranic (TRU) waste that is generated in defense and research activities regulated by the U.S. Department of Energy. The volumes of three separate categories, namely, newly generated waste, stored waste, and buried waste are reported. The data found in this report were tabulated from the most recent records of the individual sites. Characteristics presented include types of containers used, waste forms, and transuranic content.

7302 **Measurement of leach rates: a review.** Mendel, J.E. (Pacific Northwest Lab., Richland, WA). *Nuclear and Chemical Waste Management;* 3: 117-123(1982).

A historical perspective of the techniques that can be used to measure the leach rate of radioactive waste forms is presented. The achievement of leach rates that are as low as possible has been an important goal ever since the development of solidification processes for liquid radioactive wastes began in the 1950's. Leach tests can be divided into two major categories, dynamic and static, based on whether or not the leachant in contact with the test specimen is changed during the course of the test. Both types of tests have been used extensively. The results of leach tests can be used to compare waste forms, and that has been a major purpose of leach data heretofore; increasingly, however, the data now are needed for predicting long-term leaching behavior during geologic disposal. This requirement is introducing new complexities into leach testing methodology. 3 figures, 2 tables.

7303 **An accelerator-based transuranic waste assay system.** Nieschmidt, E.B.; Johnson, L.O.; Lawrence, R.S.; Tsang, F.Y.; Vegors, S.H. (EG & G Idaho Inc., P.O. Box 1625, Idaho Falls, Idaho 83415). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-28: No. 2, 1654-1657(Apr 1981). (CONF-801111—).

From 6. conference on application of accelerators in research and industry; Denton, TX, USA (3 Nov 1980).

Development of a system for the assay of waste materials at the Idaho National Engineering Laboratory is discussed. The assay method uses photons, available from bremsstrahlung, to induce fission in transuranic (TRU) materials. Radiations emitted following fission are detected and used to quantify the TRU. Reasons for the selection of the technique are presented. The experimental program and development of appropriate instruments are described. Experimental results and difficulties with this application of accelerators are also presented. Present detection limits for natural uranium are 110 mg using 8 MeV electrons and counting prompt neutrons and 36 mg using 16 MeV electrons and counting delayed neutrons. Both detection limits are determined using 4000 μC of accelerated charge. The instrument system is capable of counting prompt neutrons as soon as 30 μs after the "gamma flash" with 16 MeV electrons and 500 mA beam current.

7304 **Entsorgung. Zwischenergebnisse zum Salzstock Gorleben. (Radioactive waste management. Provisional results concerning the salt deposit Gorleben. Report of an information meeting as part of the energy dialogue in the Federal Republic of Germany).** Bonn, Germany, F.R.; Bundesministerium fuer Forschung und Technologie (1981). 563p. (In German). (CONF-8105227—). Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.). Referat Presse- und Oeffentlichkeitsarbeit.

From Information meeting within the framework of the energy dialogue; Luechow, F.R. Germany (15 May 1981).

The concept comprises a well drilling program and hydrogeological investigations, in particular working methods for inspection of the near-surface strata Quarternary, Tertiary and of the ground water. Series of strata and tectonics in the salt deposit have been examined with respect to creep behaviour, leach troughs, solidity and seismic stability.

0530 Environmental Aspects

REFER ALSO TO CITATION(S) 7272, 7285, 7295, 7296, 7298, 7309, 7310, 8102, 8196, 8558

7305 **(DOE/ID—10116-Vol.1) Plan for studies of subsurface radionuclide migration at the Radioactive Waste Management Complex of the Idaho National Engineering Laboratory. Volume 1 of 2.** (Department of Energy, Idaho Falls, ID (USA). Idaho Operations Office). Nov 1983. 159p. NTIS, PC A08/MF A01. Order Number DE84004946.

This document describes planned studies of subsurface radionuclide migration at the Radioactive Waste Management Complex of the Idaho National Engineering Laboratory. A plan is provided for each proposed study. The rational for arriving at the list of proposed studies is also presented. This document consists of two volumes. In the first volume, Sections 1 through 5 contain the introduction, the objectives of the proposed studies, and background information. The discussion is not comprehensive in detail; documents are referenced that discuss the background material in greater detail. Sections 6 through 9 identify and select the group of studies to be performed and discuss the peer review process. The second volume contains Appendices A and B, which present the assignment of responsibilities and the detailed plans, schedules, and costs for the proposed program.

7306 **(DOE/ID—10116-Vol.2) Plan for studies of subsurface radionuclide migration at the Radioactive Waste Management Complex of the Idaho National Engineering Laboratory. Volume 2 of 2. Appendices.** (Department of Energy, Idaho Falls, ID (USA). Idaho Operations Office). Nov 1983. 297p. NTIS, PC A13/MF A01. Order Number DE84004947.

Portions are illegible in microfiche products.

This document describes planned studies of subsurface radionuclide migration at the Radioactive Waste Management Complex of the Idaho National Engineering Laboratory. A plan is provided for each proposed study. The rational for arriving at the list of proposed studies is also presented. This document consists of two volumes. In the first volume, Sections 1 through 5 contain the introduction, the objectives of the proposed studies, and background information. The discussion is not comprehensive in detail; documents are referenced that discuss the background material in greater detail. Sections 6 through 9 identify and select the group of studies to be performed and discuss the peer review process. The second volume contains Appendices A and B, which present the assignment of responsibilities and the detailed plans, schedules, and costs for the proposed program.

7307 **(PNL-SA—11610) Diffusion coefficients of radon in candidate soils for covering uranium mill tailings.** Kalkwarf, D.R.; Silker, W.B. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1983. Contract AC06-76RL01830. 10p. (CONF-840245—1). NTIS, PC A02/MF A01. Order Number DE84003261.

From 6. symposium on management of uranium mill tailings, low-level waste, and hazardous waste; Fort Collins, CO, USA (1 Feb 1984).

Diffusion coefficients were measured for radon in 34 soils that had been identified by uranium mill personnel as candidate soils for covering their tailings piles in order to reduce radon emission. The coefficients referred to diffusion in the total pore space of the soils. They were measured by a steady-state method using soil columns compacted to greater than 80% of their Proctor maximum packing densities, but with moisture contents generally less than would be expected at a tailings site. Three published empirical equations relating diffusion coefficients to soil moisture and porosity were tested with these data. The best fir was obtained with the equation: $D = 0.70 \exp [-4(m-mP^2+m^2)]$ in which P is the dry porosity of the soil and m is its moisture saturation, i.e. the fraction of pore volume filled with water. This equation was used to extrapolate measured coefficients to values expected at soil-moisture contents representative of tailings sites in the western United States. Extrapolated values for silty sands and clayey sands range from 0.004 to 0.06 cm^2/s where w, the weight ratio of water to dry soil, is expected to vary from 0.04 to 0.09. Values for inorganic silts and clays ranged from 0.001 to 0.02 cm^2/s where w is expected to vary from 0.10 to 0.13. 8 references, 1 figure, 1 table.

0540 Health And Safety

7308 **(NUREG/CR—3125) Current practices for maintaining occupational exposures ALARA at low-level waste disposal sites.** Hadlock, D.E.; Herrington, W.N.; Hooker, C.D.; Murphy, D.W.; Gilchrist, R.L. (Pacific Northwest Lab., Richland, WA (USA)). Dec 1983. Contract AC06-76RL01830. 95p. (PNL—4372). NTIS, PC A05/MF A01 - GPO $4.75. Order Number DE84004659.

The United States Nuclear Regulatory Commission contracted with Pacific Northwest Laboratory (PNL) to provide technical assistance in establishing operational guidelines, with respect to radiation control programs and methods of minimizing occupational radiation exposure, at Low-Level Waste (LLW) disposal sites. The PNL, through site visits, evaluated operations at LLW disposal sites to determine the adequacy of current practices in maintaining occupational exposures as low as is reasonably achievable (ALARA). The data sought included the specifics of: ALARA programs, training programs, external exposure control, internal exposure control, respiratory protection, surveillance, radioactive waste management, facilities and equipment, and external dose analysis. The results of the study indicated the following: The Radiation Protection and ALARA programs at the three commercial LLW disposal sites were observed to be adequate in scope and content compared to similar programs at other types of nuclear facilities. However, it should be noted that there were many areas that could be improved upon to help ensure the health and safety of occupationally exposed individuals.

7309 **(NUREG/CR—3395) Influence of cover defects on the attenuation of radon with earthen covers.** Kalkwarf, D.R.; Mayer, D.W. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1983. Contract AC06-76RL01830. 33p. (PNL—4776). NTIS, PC A03/MF A01 - GPO $3.75. Order Number DE84004273.

Experimental and theoretical evaluations of radon flux through laboratory-scale defective soil columns are presented together with a survey of literature on the formation and prevention of defects in soil covers. This report focuses on air-filled, centimeter-scale defects that are most probable in earthen covers for attenuating radon emission from uranium-mill tailings. Examples include shirnkage and erosion cracks, erosion piping, animal burrows and air channels formed by the biodegradation of vegetation roots. Calculations based on mathematical models indicate that collections of defects which could increase the radon flux from an earthen cover by a factor of two would be easily detected by visual inspection. However, these models ignore air-turbulence in the defect and drying of the soil around the defect. Laboratory measurements showed that turbulent diffusion of radon occurred through defects as narrow as 0.3 cm when subjected to a transverse air velocity of 1 to 6 miles per hour at the surface. Both turbulence and more-rapid drying of soil can accelerate radon flux to the cover surface. Consequently, recommended methods to inhibit defect formation should be applied. 29 references, 3 figures, 5 tables.

7310 **Radiological hazards of waste containing alpha-emitting radionuclides.** Rodgers, J.C. (Environmental Science Group, Los Alamos National Laboratory, Los Alamos, New Mexico). *Nuclear and Chemical Waste Management;* 4: No. 1, 95-102(1983).

The radiological hazards of alpha-contaminated wastes are discussed in this overview in terms of two components of hazard: radiobiological hazard and radioecological hazard. Radiobiological hazard refers to human uptake of alpha-emitters by inhalation and ingestion, and the resultant dose to critical organs of the body. Radioecological hazard refers to the processes of release from buried wastes, transport in the environment, and translocation to man through the food chain. Besides detailing the sources and magnitude of hazards, this brief review identifies the uncertainties in their estimation, and implications for the regulatory process.

0550 Regulations

REFER ALSO TO CITATION(S) 8098, 8439

7311 **(BNL—33947) NLO error propagation exercise data collection system.** Keisch, B.; Bieber, A.M. Jr. (Brookhaven National Lab., Upton, NY (USA)). 1983. Contract AC02-76CH00016. 5p. (CONF-831106—21). NTIS, PC A02/MF A01. Order Number DE84004626.

From Topical meeting on safeguards technology - the process safeguards interface; Hilton Head Island, SC, USA (28 Nov 1983).

A combined automated and manual system for data collection is described. The system is suitable for collecting, storing, and retrieving data related to nuclear material control at a bulk processing facility. The system, which was applied to the NLO operated Feed Materials Production Center, was successfully demonstrated for a selected portion of the facility. The instrumentation consisted of off-the-shelf commercial equipment and provided timeliness, convenience, and efficiency in providing information for generating a material balance and performing error propagation on a sound statistical basis.

7312 **(BNL—33949) Understanding national and international safeguards: an evolutionary process.** Higinbotham, W.A. (Brookhaven National Lab., Upton, NY (USA)). 1983. Contract AC02-76CH00016. 5p. (CONF-831106—22). NTIS, PC A02/MF A01. Order Number DE84004631.

From Topical meeting on safeguards technology - the process safeguards interface; Hilton Head Island, SC, USA (28 Nov 1983).

Domestic and international safeguards have been evolving and will continue to evolve. in the case of the United States, the concern was to protect the classified materials, at first. Then attention focussed on material accounting, then on measures to promptly detect theft by individuals with access, and later on physical protection to ward-off armed terrorists. The objective of the IAEA has always been to provide assurance that nuclear materials are not being diverted from the peaceful facilities that are under safeguards. The evolution has taken place in deciding how to provide this assurance, and in the definition of specific safeguards goals. In both cases the technology needed to meet the goals has improved due to R and D and to experience. A plea is made for more cooperation betwen those who develop and manage the policies, those who develop safeguards techniques, and those who are subject to national and IAEA safeguards. Some illustrations of the evolution of policies, inadequate coordination and general progress are given.

7313 **(CONF-831106—19) Optimal interface between principal deterrent systems and material accounting.** Deiermann, P.J.; Opelka, J.H. (Washington Univ., St. Louis, MO (USA); Argonne National Lab., IL (USA)). 1983. Contract W-31-109-ENG-38. 7p. NTIS, PC A02/MF A01. Order Number DE84004001.

From Topical meeting on safeguards technology - the process safeguards interface; Hilton Head Island, SC, USA (28 Nov 1983).

The purpose of this study is to find an optimal blend between three safeguards systems for special nuclear material (SNM), the material accounting system and the physical security and material control systems. The latter two are denoted as principal deterrent systems. The optimization methodology employed is a two-stage decision algorithm, first an explicit maximization of expected diverter benefits and subsequently a minimization of expected defender costs for changes in material accounting procedures and incremental improvements in the principal deterrent systems. The probability of diverter success function dependent upon the principal deterrents and material accounting system variables is developed. Within the range of certainty of the model, existing material accounting, material control and physical security practices are justified.

7314 **(LA-UR—83-3392) Fine tuning of a measurement control program at the Los Alamos National Laboratory.** Goldman, A.S.; Marshall, R.S. (Los Alamos National Lab., NM (USA)). 1983. Contract W-7405-ENG-36. 8p. (CONF-831106—5). NTIS, PC A02/MF A01. Order Number DE84003836.

From Topical meeting on safeguards technology - the process safeguards interface; Hilton Head Island, SC, USA (28 Nov 1983).

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This paper suggests a revised measurement control program (MCP) for balance at the Los Alamos National Laboratory plutonium facility. The revised MCP is based on an analysis of data taken from June 1981 through August 1983. The most important finding is that significant measurement bias occurs in nearly every balance. An important cause of this bias has been traced to truncation errors, and a detailed discussion of the effects of truncation errors is presented. We also discuss other sources of bias and their resolution, and finally, we suggest methods for determining accuracy, precision, and randomness of measurements of weights and the response to failures of statistical tests.

7315 **(NUREG/CR—2078) Handbook of nuclear safeguards measurement methods.** Rogers, D.R. (ed.). (Monsanto Research Corp., Miamisburg, OH (USA). Mound). Sep 1983. Contract AC04-76DP00053. 743p. (MLM—2855). NTIS, PC A99/MF A01 - GPO $15.00. Order Number DE84004160.

This handbook is intended to be a guide to the selection of methods for meeting specific measurement requirements. The information was compiled from a survey of production facilities, the literature, and current exchange programs. The survey included bulk measurements, chemical assay, sampling techniques, isotopic measurements, passive NDA, and active NDA. (DLC)

7316 **(NUREG/CR—3088) Automated deficiency letter data base.** Jones, R.D. (Sandia National Labs., Albuquerque, NM (USA)). Dec 1983. Contract AC04-76DP00789. 58p. (SAND—82-0767). NTIS, PC A04/MF A01 - GPO $4.50. Order Number DE84004661.

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An automated data base relevant to the various licensee deficiencies that accrue during the materials licensing application review process of the Nuclear Regulatory Commission (NRC) is described. A data base management system (DBMs) is used for data retrieval, file-tending, and examination of the interrelationships among the data types in the data base. Use of word processors to emulate computer terminals for the purpose of data base population (loading) and report generation is discussed. Also described is the technique used to link, for update purposes, the data base (accessed by means of SYSTEM 2000 on a CDC 6600 computer) to the NRC Material License Master File resident on the National Institutes of Health (NIH) IBM System 370 computer. A user's manual that provides easy-to-understand instructions for the nonprogramming user on how to generate ad hoc analytical reports to facilitate management decisions is also included.

7317 **(NUREG/CR—3256) Assessment of alternatives to correct inventory difference statistical treatment deficiencies.** Byers, K.R.; Johnston, J.W.; Bennett, C.A.; Brouns, R.J.; Mullen, M.F.; Roberts, F.P. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1983. Contract AC06-76RL01830. 85p. (PNL—4656). NTIS, PC A05/MF A01 - GPO $4.50. Order Number DE84004272.

This document presents an analysis of alternatives to correct deficiencies in the statistical treatment of inventory differences in the NRC guidance documents and licensee practice. Pacific Northwest Laboratory's objective for this study was to assess alternatives developed by the NRC and a panel of safeguards statistical experts. Criteria were developed for the evaluation and the assessment was made considering the criteria. The results of this assessment are PNL recommendations, which are intended to provide NRC decision makers with a logical and statistically sound basis for correcting the deficiencies.

7318 **(NUREG/CR—3347-Vol.1) Materials licensing study, Phase 1. Volume I. Data collection and analysis.** Arcuni, A.A.; Elliott, J.M.; Immerman, W.H.; Owens, J.E.; Welles, B.W.; Varnado, G.B. (International Energy Associates Ltd., Washington, DC (USA); Sandia National Labs., Albuquerque, NM (USA)). Nov 1983. Contract AC04-76DP00789. 132p. (SAND—83-7081-Vol.1). NTIS, PC A07/MF A01 - GPO $7.00. Order Number DE84004270.

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This is one of seven reports which describe a study of nuclear material licensing conducted for the Office of Nuclear Regulatory Materials Safety and Safeguards, US NRC. Purpose is to analyze the process used by NRC to license nuclear materials, and to recommend measures to improve the efficiency of such license application review. This portion of the study conducted five interrelated reviews of the materials licensing process and documented the data collection method and results. SAND83-7081/2of3 summarizes associated findings and recommendations. One review characterized categories of application deficiencies seen in a sample of deficiency letters. Another examined the application process longitudinally through analysis of several dockets over the course of a license action. In a different review, all major nuclear materials application guides were assessed, and compared with regulatory requirements. The study also reviewed the flow of materials licensing information, and estimated the time required to process an application established milestones. This data was used as input to a simulation model of the materials licensing process, described in SAND82-0697. Finally, the report established a system basis for evaluating proposed changes in license renewal requirements.

7319 **(NUREG/CR—3347-Vol.3) Materials licensing study. Phase 1. Task 9 report: evaluation of medical license renewals using the preprinted form. Volume 3.** Welles, B.W.; Varnado, G.B. (International Energy Associates Ltd., Washington, DC (USA)). Nov 1983. Contract AC04-76DP00789. 57p. (SAND—83-7081-Vol.3). NTIS, PC A04/MF A01 - GPO $4.25. Order Number DE84004281.

This report describes the trial use of a preprinted license renewal form to reduce processing time. Other analyses (SAND83-7081/1 of 3 and SAND83-7081/2 of 3) have concluded that license renewals generate more deficiency letters than other actions, and that these contribute significantly to license processing time. This effort developed a preprinted form which utilized existing license data and standardized responses to complete most of a renewal application. This was mailed to selected licensees in advance of their license expiration. Results are tabulated in the report, but do not provide a statistically valid basis for conclusion on the effectiveness of this procedure. The report recommends continuing the use of a modified procedure, establishing a better basis for evaluation, and identifying opportunities for use in other license categories.

7320 (NUREG/CR—3348) Functional requirements definition of the Licensing Management System (LMS). Immerman, W.H.; Arcuni, A.A.; Elliott, J.M.; Chapman, L.D. (International Energy Associates Ltd., Washington, DC (USA)). Nov 1983. Contract AC04-76DP00789. 57p. (SAND—83-7080). NTIS, PC A04/MF A01 - GPO $4.50. Order Number DE84004282.

This report defines functional requirements for an automated materials licensing aid called the Licensing Management System (LMS). The objective of the LMS was given: to provide a support system for materials licensing that makes an average processing time of forty-five days feasible for license applications. From this, and from data previously collected and analyzed a set of functional requirements were defined, describing both general characteristics of an LMS, and specific functions which the LMS must perform. The report expresses these as a hierarchy of functions. The highest level functional elements in the hierarchy are to perform: license processing; status/monitoring; management support; and administrative support.

7321 (NUREG/CR—3349) Licensing management system prototype system design. Immerman, W.H.; Arcuni, A.A.; Elliott, J.M.; Chapman, L.D. (International Energy Associates Ltd., Washington, DC (USA); Sandia National Labs., Albuquerque, NM (USA)). Nov 1983. Contract AC04-76DP00789. 115p. (SAND—83-7082). NTIS, PC A06/MF A01 - GPO $4.75. Order Number DE84004285.

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This report is a design document for a prototype implementation of a licensing management system (LMS) as defined in SAND83-7080. It describes the concept of operations for full implementation of an LMS in accordance with the previously defined functional requirements. It defines a subset of a full LMS suitable for meeting prototype implementation goals, and proposes a system design for this subset. The report describes overall system design considerations consistent with, but more explicit than the general characteristics required by the LMS functional definition. A high level design is presented for just those functions selected for prototype implementation. The report also provides a data element dictionary describing the structured logical data elements required to implement the selected functions.

06 Sources

REFER ALSO TO CITATION(S) 8176

07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY

0701 Physical Isotope Separation

REFER ALSO TO CITATION(S) 8157

7322 (CEA-N—2348) Preparation of samples with very high enrichment in ^{13}C by multiphoton dissociation of $^{13}CF_3I$ with a CO_2 TEA laser. Cauchetier, M.; Croix, O.; Luce, M.; Tistchenko, S. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Physico-Chimie). May 1983. 27p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84750214.

The multiphoton dissociation of CF_3I by selective irradiation of $^{13}CF_3I$ with a CO_2 TEA laser has permitted to obtain isotopic concentration in ^{13}C greater than 90% as well by static method (closed cell) as by dynamic method (continuous flow). After C_2F_6 purification a sample with 90% in $^{13}CF_3I$ has been irradiated again in closed cell to obtain an isotopic concentration of 99.93% in $^{13}CF_3I$, 40% of the initial $^{13}CF_3I$ being preserved. This gives an enrichment of 130000 in two steps.

7323 The UNISOR Isotope Separator Facility. Carter, H.K. (UNISOR, Oak Ridge Associated Universities, Oak Ridge, Tennessee 37830). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-28: No. 2, 1481-1484(Apr 1981). (CONF-801111—).

From 6. conference on application of accelerators in research and industry; Denton, TX, USA (3 Nov 1980).

The UNISOR facility is an Isotope Separator system on-line to the Oak Ridge National Laboratory Isochronous Cyclotron (ORIC). The current status of the facility is described including available accelerator beams, targets and ion sources, separator beamlines and source handling equipment, and data acquisition systems.

0702 Radiation Sources

7324 (FERMILAB/TM—1146) Update of neutron dose yields as a function of energy for protons and deuterons incident on beryllium targets. Ten Haken, R.K.; Awschalom, M.; Rosenberg, I. (Fermi National Accelerator Lab., Batavia, IL (USA)). Nov 1982. Contract AC02-76CH03000. 11p. NTIS, PC A02/MF A01. Order Number DE84003667.

Neutron absorbed dose yields (absorbed dose rates per unit incident current on targets at a given SAD or SSD) increase with incident charged particle energy for both protons and deuterons. Analyses of neutron dose yield versus incident particle energy have been performed for both deuterons and protons. It is the purpose of this report to update those analyses by pooling all of the more recent published results and to reanalyze the trend of yield, Y, versus incident energy, E, which in the past has been described by an expression of the form Y = aE/sup b/, where a and b are empirical constants. From the reanalyzed trend it is concluded that for a given size cyclotron (E/sub p/ = 2E/sub d/), the dose yields using protons are higher than those using deuterons up to a proton energy E/sub p/ of 64 MeV.

7325 Industrial tomography applications. Hopkins, F.F.; Ellinger, H.D.; Klinksiek, R.V.; Meyer, G.A.; Morgan, I.L.; Thompson, J.N. (Scientific Measurement Systems, Inc., Austin, Texas). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-28: No. 2, 1717-1720(Apr 1981). (CONF-801111—).

From 6. conference on application of accelerators in research and industry; Denton, TX, USA (3 Nov 1980).

The technique of computerized photon tomography has been applied in the nondestructive evaluation of a number of inanimate objects. Hardware and software capabilities for industrial tomographic analysis, particularly of high-density objects, have been developed. Spatial resolution is on the order of 1-2mm for density variations of a few percent.

7326 Nonmedical application of computed tomography to power capacitor quality assesment. Kruger, R.P. (Los Alamos Scientific Laboratory, Los Alamos, New Mexico 87545). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-28: No. 2, 1721-1725(Apr 1981). (CONF-801111—).

From 6. conference on application of accelerators in research and industry; Denton, TX, USA (3 Nov 1980).

Present research and development efforts at Los Alamos Scientific Laboratory require the design and use of high-efficiency rapid-discharge energy storage capacitors for laser isotope separation and plasma physics programs. In these applications, capacitors are subjected to electrical, mechanical, thermal, and other environmental stresses. These stresses cause the dielectric constant to change due to gasification from arcing at nonsoldering connections, which produce a chemical reduction of the dielectric material. This effectively limits the lifetime of the capacitor. The programs mentioned above require capacitors with a multikilohertz frequency response at a current of tens of kiloamperes and a voltage of at least 100 kV. The lifetime of such capacitors should exceed 10^{10} charge/discharge cycles. Such capacitors do not presently exist. The exploration of new capacitor designs will require the use of both electrical functional tests and tests that show the changes in internal physical structure as the capacitor is repeatedly stressed by the charge/discharge cycle. The integration of electrical and structural tests throughout the life cycle of a candidate capacitor makes it imperative that the structural integrity tests be nondestructive. Computed tomography (CT) makes this integration possible. The work reported here is the result of a pilot project designed to show the poten-

tial use of CT for this application. This work includes visualization of material defects using both a layered sequence of conventional tomographic slices and orthogonal multiangular pseudoradiographs generated from these slices.

7327 **Dye film dosimetry for radiation processing.** Humphreys, J.C.; McLaughlin, W.L. (National Bureau of Standards, Washington, DC 20234). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-28: No. 2, 1797-1801(Apr 1981). (CONF-801111—).

From 6. conference on application of accelerators in research and industry; Denton, TX, USA (3 Nov 1980).

Commercially available plastic films containing dyes or dye precursors are convenient dosimeters and imaging media for electron beams or photons used for industrial radiation processing. As "grainless" imaging systems having thicknesses down to a few micrometers, they provide high spatial resolution for determining detailed absorbed dose distributions through microdensitometric analysis. The radiation absorption properties of these systems are adjusted by changing film composition so that the dosimeter materials can be made to simulate the material of interest undergoing irradiation. Other advantages include long-term stability, dose-rate independence, and ease of use and calibration. Radiochromic dye films with thicknesses varying from 0.005 to 1 mm are presently used to monitor electron-beam or gamma-ray doses from 10 to 10^5 Gy (10^3 to 10^7 rad), typical of those encountered in medical applications, radiation curing of polymeric composites, wire and cable insulation, shrinkable plastic tubing and film, as well as sterilization of medical supplies and treatment of municipal and industrial wastes. An NBS calibration service to industry involves the traceability of standard ^{60}Co gamma ray absorbed dose measurements by means of these films employed as transfer standards.

0703 Isotopic Power Supplies

REFER ALSO TO CITATION(S) 7748

7328 **(LA—9487-MS-Vol.2) Long-term exposure of $^{238}PuO_2$ to a terrestrial environment. Volume 2.** Patterson, J.H.; Heaton, R.C.; Herrera, B.; Nelson, G.B.; Steinkruger, F.J. (Los Alamos National Lab., NM (USA)). Sep 1983. Contract W-7405-ENG-36. 52p. NTIS, PC A04/MF A01. Order Number DE84003703.

Two environmental simulation chambers were used to study the behavior of a $^{238}PuO_2$ heat source deposited in a humid, temperate environment. Large fragments from an impact-tested source were deposited in the first chamber, and fines from the source were placed in the second. Plutonium released into the soil, the soil drainages, and the condensates from the dehumidifiers were monitored throughout the experiment. The concentration of plutonium released into the soil drainages increased with time, obeying an apparent exponential growth curve over the duration of the experiment (5.7 yr). The bulk of the released plutonium, up to 0.3% of the source, was retained in the soil. A simulated cleanup operation at the conclusion of the experiment, which included removal of the source and the top inch of soil, resulted in an increased rate of plutonium release into the soil drainage and essentially no observable change of release rate into the air. Large chunks of PuO_2 deposited in one of the chambers underwent spontaneous disintegration into smaller pieces; after 2 yr the deposited material could barely be distinguished from the fines deposited in the other chamber.

08 HYDROGEN

0801 Production

REFER ALSO TO CITATION(S) 7352, 7353, 7370, 7725, 8158, 8167, 8180, 8189

7329 **(DOE/ER/10671—2) Intramolecular energy transfer reactions as a method for metal complex assisted production of hydrogen. Second biannual report, 15 February 1982-1 December 1983.** Petersen, J.D. (Clemson Univ., SC (USA). Dept. of Chemistry). 1983. Contract AS09-80ER10671. 21p. NTIS, PC A02/MF A01. Order Number DE84004762.

This program is interested in absorbing energy in one portion of a polymetallic complex, transferring that energy to another portion of the molecule, and allowing this remote center to undergo a desired chemical reaction. One advantage of this intramolecular energy transfer process over the more common intermolecular processes is that the inherent inefficiencies of bimolecular collisional processes can be circumvented. Another advantage is that coupling of more than one metal fragment into one complex, each fragment having different properties, (i.e., light absorbing, reacting, etc.) allows the ultimate flexibility in the design of the overall system. The results contained in this report deal with our progress in developing intramolecular energy transfer systems. We have divided up the reactant molecules into three component parts, the antenna fragment (highly absorbing metal center), the reactive fragment (center that undergoes reaction), and the bridge (ligand that connects and couples the two metal centers. Most of the systems studied contain the bridging ligand 2,2'-bipyrimidine, which functions as a chelate to both the antenna and reactive fragment. This bridging system has the advantages that it maintains the integrity of the polymetallic systems and is very effective in electronically coupling the metal centers to each other. The photochemistry of some metal dihydrido reactive fragments is added to the previous information obtained on a series of antenna fragments.

0802 Storage

7330 **Enhancement of the Lacher and Rees theories of hydrogen absorption isotherms.** Kierstead, H.A. (Argonne National Lab., IL). *Journal of the Less-Common Metals;* 77: 281-285(1981).

The theories of Lacher and Rees that fit a single hydrogen absorption isotherm so well are sometimes unable to fit the temperature dependence of the isotherms. This failure results from two simplified assumptions, common to both theories, and ways to make these assumptions more realistic are discussed. Data from five isotherms of $ErFe_2$ hydrides were used for development of a new parameter which represents the temperature dependence of the plateau pressures and results in better fit for the isotherms to the multiplateau Lacher theory. In the case of the Rees theory, one phase region of the experimental five isotherms of $DyCo_2$ hydrides fitted poorly, because in this region the calculated isotherms flatten as the temperature rises. This deficiency was corrected by the addition of a temperature-independent term. Data are presented for the isotherms fitted by the enhanced theories, and improvements in the fit are very evident. (BLM)

7331 **Getting metal hydrides to do what you want them to.** Gruen, D.M. (Argonne National Lab., IL). pp 1-18 of Metal-hydrogen systems. Veziroglu, T.N. (ed.). New York, NY; Pergamon Press (1981).

From Miami international symposium on metal-hydrogen systems; Miami Beach, Florida, USA (13 April 1981).

Modifications of metal hydrides, in order to optimize them for particular applications such as chemical heat pumps, are discussed. The $LaNi_5$-H_2 phase diagram is described. The AB_5 hydrides may be useful for chemical heat pump systems; with a pair of hydrides having different dissociation pressures, one can, by means of a thermal gradient, transfer hydrogen from one to the other hydride, and therefore construct a chemical heat pump. The question of choosing the right pair of metal hydrides is next considered. A systematic study substituting Al for Ni was carried out. The enthalpy of hydridation changes linearly with the Al content and cell volume. A new family of hydrogen getters has been developed. Other applications of metal hydrides are touched upon. (DLC)

0808 Properties

REFER ALSO TO CITATION(S) 8207

09 OTHER SYNTHETIC AND NATURAL FUELS

0901 Hydrocarbon Fuels

REFER ALSO TO CITATION(S) 7796

7332 **(PNL-SA—11807) Biomass liquefaction product analysis and upgrading.** Elliott, D.C.; Baker, E.G. (Pacific Northwest Lab., Richland, WA (USA)). Sep 1983. Contract AC06-76RL01830. 11p. (CONF-8309194—1). NTIS, PC A02/MF A01. Order Number DE84003344.

From Biomass liquefaction experts meeting; Sherbrooke, Quebec, Canada (29 Sep 1983).

This paper presents an update of the analytical and process research underway in biomass liquefaction at the Pacific Northwest Laboratory operated by Battelle Memorial Institute for the US Department of Energy. Product analyses have been performed on a slate of products supplied by laboratories doing research on biomass liquefaction through the Comparative Test Program of the International Energy Agency, Forestry Energy Cooperative Project D-1, Biomass Liquefaction Test Facility. Through this series of comparative analyses, a number of conclusions can be drawn relative to wood vs. peat as a feedstock and pyrolysis vs. high pressure processing. Process research results on upgrading biomass liquefaction products through catalytic hydrodeoxygenation are also included. These results point toward the production of high-valued transportation fuels from the crude biomass liquefaction products.

7333 **Mass transfer and product selectivity in a mechanically stirred Fischer-Tropsch slurry reactor.** Satterfield, C.N.; Huff, G.A. Jr. (Massachusetts Inst. of Tech., Cambridge). pp 225-236 of Chemical reaction engineering. Washington, DC; American Chemical Society (1982). Contract FG22-81PC40771.

With a reduced fused magnetite catalyst a substantial gas-to-liquid mass transfer resistance can be encountered, which causes the paraffin-to-olefin ratio of the hydrocarbon products to decrease. Under intrinsic kinetic conditions this ratio increases with hydrogen concentration in the liquid but is independent of carbon monoxide concentration. Hence with significant mass-transfer, this ratio is governed by the resistance to H_2 transfer rather than by the effective H_2/CO ratio in the liquid. 16 references, 5 figures, 1 table.

0902 Alcohol Fuels

REFER ALSO TO CITATION(S) 7796

7334 **(CONF-8306135—Pt.1) Decomposed methanol workshop report alternative fuels utilization contractors' coordination meeting. Part 1.** (USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC. Office of Vehicle and Engine Research and Development). Oct 1983. 62p. NTIS, PC A04/MF A01. Order Number DE84003927.

From Alternative fuels utilization contractors coordination meeting; Windsor, Ontario, Canada (7 Jun 1983).

The proceedings of a workship of researchers and potential users of decomposed method fuel for Otto cycle engines are presented. The purpose of the meeting was to review the state-of-the-art. Proponents for its use state that by using exhaust waste heat to decompose the methanol, the resulting gaseous fuel constituents have more energy content than that in the original liquid. The drawbacks include the unapplicability during engine warmup and the fraction of automobile duty cycle related thereto, the reduced volumetric efficiency associated with any gaseous fuel, and the tradeoffs between improved thermal efficiency and reduced power output with lean fuel mixtures. There has always been a dilemma as to whether a decomposed methanol system is a variation on the application of methanol, of hydrogen, or both. However, the more immediate issue is whether use of methanol is liquid, decomposed or dual form is the most cost effective and energy efficient way to use it. Various participants presented the results of their work on the subject to provide the basis for discussion. The first part of this document reviews these. The resulting discussion was followed by the two disinterested observers, who attempted to capture the essence of it. Their reports complete this document. (DMC)

7335 **(DOE/R5/10244—4) Farm ethanol production demonstration. Progress report, September 1, 1981-August 30, 1983.** Longbrake, W.R. (Ohio State Univ., Wooster (USA). Agricultural Technical Inst.). Dec 1983. Contract FG02-80R510244. 146p. NTIS, PC A07. Order Number DE84004213.

Paper copy only, copy does not permit microfiche production.

This report contains engineering drawings of an ethanol demonstration production unit at the Agricultural Technical Institute Campus in Wooster, Ohio. A brief description of the cooking unit and distillation unit are included. (DMC)

7336 **(PB—83-243030) Preliminary evaluation of the pretreatment of fuel alcohol fermentation stillage through an anaerobic filter.** Jacquez, R.B.; Sales, A.; Wang, W. (Missouri Univ., Rolla (USA)). Nov 1982. 30p. NTIS, PC A03/MF A01.

The objective of this research was to conduct a preliminary evaluation of the pretreatment of fuel alcohol fermentation stillage by means of an anaerobic filter. The first phase of the investigation was devoted to characterizing the stillage. The second phase of the investigation studied the reduction of suspended solids by centrifugation. In the third phase of the investigation laboratory scale anaerobic filters were tested as a means of pretreating the fermentation stillage. Overall, the anaerobic filter was demonstrated to be an effective means of pretreating fermentation stillage.

7337 **Alkali promoted Cu/ZnO catalysts for low alcohol synthesis.** Vedage, G.A.; Himelfarb, P.; Simmons, G.W.; Klier, K. (Lehigh Univ., Bethlehem, PA). *American Chemical Society, Division of Petroleum Chemistry, Preprints;* **28**: No. 5, 1261-1271(Sep 1983). (CONF-830814—Vol.2).

From 186. national meeting of the American Chemical Society; Washington, DC, USA (28 Aug 1983).

This study addressed the mechanistic questions including the role of the basicity, distribution and chemical state of the alkali by determining the influence of different alkali hydroxides on the activity and selectivity of a low-temperature, low-pressure methanol catalyst. The previously characterized 30/70 copper/zinc oxide (Cu/ZnO) was chosen for this investigation. The product distributions were determined for each of the alkali-doped catalysts at 250°C and 288°C with different ratios of H_2/CO and were compared with the product distribution obtained with undoped catalyst under the same experimental conditions. Various alcohols were added to the H_2/CO synthesis gas to identify precursors which might be involved in the chain growth of other alcohols. The effect of CO_2 in the syngas was also determined. The activities and selectivities of the catalysts were correlated with their morphology, composition and structure, as determined by X-ray powder diffraction, scanning transmission electron microscopy and photoelectron spectroscopy. 5 figures, 4 tables.

0904 Solid Waste And Wood Fuels

REFER ALSO TO CITATION(S) 7364, 7366, 7377, 8276, 8467

7338 **(CONF-830381—) Proceedings of solid fuel heating technology symposium.** (Wood Heating Education and Research Foundation, Washington, DC (USA); Auburn Univ., AL (USA). Dept. of Mechanical Engineering; USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC). Aug 1983. 219p. NTIS, PC A10/MF A01. Order Number DE83017816.

From Solid fuel heat technology symposium; Baltimore, MD, USA (11 Mar 1983).

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Most of the papers at the symposium dealt with the efficiency of wood and coal burning stoves or the standardization of the measurement of their efficiency. Discussed were stack loss testing; the ranking of home heating systems using calorimeter houses; emissions, efficiency, and combustion chamber conditions in a coal stove; determination of the efficiency of fireplace inserts; comparison of efficiencies and emissions for conventional and new technology wood heaters; efficiency and emissions testing of wood stoves; correlation of moisture content and wood burning rate; analysis of the Orsat method; fuel variation in the burning cycle; effects of ambient temperature and forced convection on radiant stove efficiency; and the results of a safety survey of residential solid fuel heaters. All eleven papers were abstracted separately. 60 references, 65 figures, 59 tables. (CKK)

7339 (CONF-830381—, pp 1-8) **Stack loss testing and product development.** Curkeet, R.D.; Husom, J.J. (Certicon of America, Inc., Middletown, WI). Aug 1983. NTIS, PC A10/MF A01.

From Solid fuel heat technology symposium; Baltimore, MD, USA (11 Mar 1983).

An example of the use of stack loss performance testing as a solid fuel heating appliance development tool is presented. A generic woodburning radiant heater was chosen for a series of demonstration tests and design modifications. A straightforward process of test, analyze, redesign, modify and retest was used. The stakc loss test results from an initial test were used to determine where improvements could be made. Combining this information with combustion theory and physics, design changes which should produce improved performance were postulated. Modifications were then made and the stack loss test was again run to judge the effectiveness of the change and to provide data for further design refinement. Two types of modification approaches were used. In the first series presented, the changes are essentially in combustion air control and distribution and in internal baffeling. In the second series, a catalytic retrofit was employed as the major performance improvement strategy. 5 figures, 5 tables.

7340 (CONF-830381—, pp 52-63) **Determination of the efficiency of fireplace inserts by heat loss measurement.** Pegg, M.J.; MacKay, G.D.M. (Technical Univ. of Nova Scotia, Halifax). Aug 1983. NTIS, PC A10/MF A01.

From Solid fuel heat technology symposium; Baltimore, MD, USA (11 Mar 1983).

The efficiency of a fireplace insert relative to a free standing wood stove was determined. The typical fireplace will have the rear wall and chimney exposed to outside temperatures. Heat losses will occur through the rear wall as well as through the flue gas in a fireplace insert. However, the masonry of the fireplace will also act as a storage for heat some of which will be returned to the room when the fire goes out. A fireplace insert was tested with and without positive flue connections, uninsulated and insulated, with and without a blower, and as a free standing stove. Results show that the fireplace insert as a free standing unit is about 20% more efficient. Insulation and a positive flue connection increase efficiency, but the blower had only a marginal effect on efficiency. 3 figures, 1 table. (CKK)

7341 (CONF-830381—, pp 64-80) **Comparison of efficiencies and emissions for conventional and new technology wood heaters.** Knight, C.V. (Univ. of Tennessee, Chattanooga); Knight, D.K. Aug 1983. NTIS, PC A10/MF A01.

From Solid fuel heat technology symposium; Baltimore, MD, USA (11 Mar 1983).

Five wood heaters were tested for thermal efficiency and emissions: (1) a conventional non-baffled airtight circulator; (2) a new non-baffled airtight catalytic radiant heater; (3) a new retrofit, add-on catalytic combustor mated to the exit of wood heater No. 1; (4) a new baffled airtight catalytic circulator using metal instead of ceramic as a catalyst base; and (5) a new airtight unit designed to provide secondary combustion features. Tables summarize the burn rate, thermal efficiency, combustion efficiency, heat transfer efficiency, heat losses, chemical losses, and emission factors for total particulates, volatile hydrocarbons, carbon monoxide, nitrogen oxides, sulfur dioxide, and polynuclear aromatic hydrocarbons (PAH). Wood heater No. 2 ranked first in thermal, combustion, and heat transfer efficiencies and reduced particulate and PAH emissions. 10 references, 2 figures, 10 tables. (CKK)

7342 (CONF-830381—, pp 81-101) **Efficiency and emission testing for residential wood-fired appliances.** Tiegs, P. (OMNI Environmental Services, Inc., Portland, OR). Aug 1983. NTIS, PC A10/MF A01.

From Solid fuel heat technology symposium; Baltimore, MD, USA (11 Mar 1983).

Two residential wood-fired appliances were laboratory tested for efficiency performance and emissions. Both units were free-standing airtight woodstoves, one with a catalytic combustor and one with a refractory lined primary and secondary combustion chamber. Overall, heat transfer, and combustion efficiency were measured by stack gas analysis methods. Emission measurements included total particulates (solid and condensible fractions) carbon monoxide, and gaseous hydrocarbons. Other parameters included burn rates, draft measurements, and excess air. The appliances were tested under a six-hour uniform stove operating procedure which included a one-hour startup period at high fire setting with the remainder at medium burn rate. Statistical methods were used to show the reproducibility of test results. Efficiency measurement and emission sampling methods are described. New potential flow measurement techniques applicable to woodstove testing are also discussed. 4 references, 2 figures, 4 tables.

7343 (CONF-830381—, pp 102-123) **How moisture content affects wood burning rate.** Briner, C.F. (The Majestic Co., Huntington, IN). Aug 1983. NTIS, PC A10/MF A01.

From Solid fuel heat technology symposium; Baltimore, MD, USA (11 Mar 1983).

Standard UL fireplace safety tests require firebrands that are oven cured for more than 16 hours. This report shows that average firebrand burning rates may vary by as much as 26% or more, depending on the oven cure time in excess of the 16 hour minimum. Burning rates vary by 300% from 20% equilibrium moisture content (EMC) to 1% EMC. This report suggests that correlation test procedures specify a particular firebrand moisture level so as to give more uniformity between tests. Small variations in wood moisture content of nearly totally dry wood has an extreme affect on the burning rate of firebrands, a factor of two to one. Further testing of this nature is recommended to more precisely quantify the affects of moisture content variation on temperatures of combustible material surfaces surrounding fireplaces and also on the space heating output performance of the fireplace. 19 references, 19 figures, 3 tables.

7344 (CONF-830381—, pp 124-142) **Analysis of the indirect (Orsat) method for evaluating wood burning appliance performance.** Maxwell, T.T.; Dyer, D.F.; Maples, G. (Auburn Univ., AL). Aug 1983. NTIS, PC A10/MF A01.

From Solid fuel heat technology symposium; Baltimore, MD, USA (11 Mar 1983).

Several test methods are currently being used to evaluate the thermal performance of air-tight, wood burning appliances. One of these methods, commonly referred to as the Orsat Method, is an indirect test procedure based on a batch sampling process. An Orsat gas analyzer is employed to analyze the flue gas samples; hence, the name Orsat Method. This method is used most satisfactorily to ascertain the performance of industrial combustion equipment. However, unlike most industrial equipment, residential size wood burning appliances seldom operate on a steady state basis. In addition, large quantities of combustible material are frequently present in the flue gases. Finally, the actual fuel composition changes during the test procedure. For these reasons, several modifications to the traditional stack loss or indirect procedure are necessary to properly evaluate the performance of wood burning appliances. This paper presents the combustion model used in the Orsat Method. It discusses the effect of the assumptions made in applying the Orsat Method as well as the sensitivity of the results to the required measurements. 5 references, 4 figures, 4 tables.

7345 (CONF-830381—, pp 143-154) **Fuel variation through the burning cycle: implications for indirect efficiency measurements.** Braaten, R.W.; Hayden, A.C.S. (Canadian Combustion Research Lab., Ottawa). Aug 1983. NTIS, PC A10/MF A01.

From Solid fuel heat technology symposium; Baltimore, MD, USA (11 Mar 1983).

The Canadian Combustion Research Laboratory (CCRL) has been carrying out experimental and analytical work to develop a Canadian efficiency/completeness-of-combustion standard for domestic wood-fired appliances, based on the continuous measurement of combustion products. While developing the standard, experiments have been carried out whereby the fuel has been quenched at various points through the burning cycle and the changes in ultimate anlaysis determined. The instantaneous heat losses and quantities of incomplete combustion products are based on this varying fuel composition. This allows detailed evaluation of combustion system performance at any point in a burning cycle, rather than merely relying on average performance over a complete burn, giving manufacturers better guidance on how to improve performance. Detailed experimental results on the changes in fuel composition for various burning conditions are presented in this paper. 3 references, 7 figures, 1 table.

7346 (PB—83-252437) **Physical characteristics of some northern California brush fuels. Forest service general technical report.** Countryman, C.M. (Forest Service, Berkeley, CA (USA). Pacific Southwest Forest and Range Experiment Station). 1983. 14p. NTIS, PC A02/MF A01.

Brush species make up much of the fuel load in forested wildlands. Basic physical and chemical characteristics of these species influence ease of ignition, rate of fire intensity. Quantitative knowledge of the variations in bush characteristics is essential to progress in fire control and effective use of fire in wildland management. Five shrub species common to northern California brush fuels were analyzed in this study–greenleaf manzanita, snowbrush, mountain whitethorn, chinkapin, and bitter cherry. Quantitative data on ash content, fuel density, solvent extractives, surface-to-volume ratios, heating values, fuel loading by size class of material, relative amounts of dead and living fuels, vertical distribution of fuel elements, and amount of litter fuel are provided.

13 HYDRO ENERGY

1305 Economics And Management

7347 (DOE/R6/12027—T1) **Cleveland roller mill hydrogeneration feasibility study.** Cassidy, D. (comp.). (Cassidy (Daniel J.), Cleveland, NM (USA)). 11 Jan 1982. Contract FG46-80R612027. 64p. NTIS, PC A04/MF A01. Order Number DE84003118.

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The mill is located 2 miles northeast of Mora, New Mexico, on NM Highway 3. Objective was to determine if the mill's water wheel and reduction bearing can be utilized to economically generate electricity. However, because of the unfavorable economic paybacks there is no necessity in examining the advantages or disadvantages of the water wheel vs the turbine system.

14 SOLAR ENERGY

1403 Economics

7348 (NP—3770175) **Memorandum on solar technology for exports.** (Bundesverband Solarenergie, Essen (Germany, F.R.)). 1982. 16p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83770175.

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The expansion of application of solar techniques is today still being hindered by economical factors, in addition to the still outstanding technical development of the individual systems. The high investment costs of solar systems must be reduced, especially by applying techniques of production in series. In order to make this important step possible, starting aids must be provided to export markets by investment loans. The enterprises represented in the Federal Association of Solar Energy, BSE, expect the solar techniques to have very good chances in the export and therefore ask the Federal Government to cooperate in a supporting way by realising the three-point programme presented in this memorandum: - Creation of a long-term application-oriented development programme coordinated by government and industry; - A closer interlocking of the programmes of the Federal Ministries to utilize regenerative energies; - Granting special loans with low interest rates as starting aids for financing the export of solar systems.

1404 Environmental, Legal, And Institutional Aspects

7349 (DOE/R6/11992—T1) **North Arkansas Community College (NACC) Appropriate Energy Technology Resource Center. Final report, June 30, 1983.** (North Arkansas Community Coll., Harrison (USA)). 1983. Contract FG46-80R611992. 60p. NTIS, PC A04/MF A01. Order Number DE84003420.

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The aim of the reported program was to establish an Energy Resource Center, offer solar and energy conservation classes and assistance to people in the community of Harrison, Arkansas, and to conduct a similar outreach program to outlying areas. A summary of resources available in the North Arkansas Community College (NACC) Energy Center, the NACC Energy Center Resource Catalog, is attached. Efforts reported include media coverage, loan programs, a solar laboratory on wheels known as Solar Coaster, a photovoltaic demonstration project and use of a computer at the Energy Center. NACC Solar Energy Course Outlines are also attached. (LEW)

7350 (NP—3770162) **Law and solar energy.** Zimmermann, W. (Eidgenoessisches Amt fuer Energiewirtschaft, Bern (Switzerland)). Jan 1981. 67p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE83770162.

The author investigates what part the government plays in the initial phase of solar energy utilization. In a first step he finds out who deals with issues of solar energy in the national administration while in the second step the question of how far solar energy is embodied in the effective law is dealt with. A third step finally tries to give a brief outlook on the treatment of solar energy in a future article of the constitution on energy.

1405 Solar Energy Conversion

REFER ALSO TO CITATION(S) 7332, 7333, 7335, 7336, 7339, 7346, 7728, 7796, 8067, 8535

7351 (ANL/CNSV—42) **Availability of carbon dioxide for production of microalgal lipids in the Southwest.** Nelson, S.H. (Argonne National Lab., IL (USA)). Jan 1983. Contract W-31-109-ENG-38. 42p. NTIS, PC A03/MF A01. Order Number DE84004195.

Microalgae can be used to produce lipids, which can be refined and used to displace petroleum. In the continental United States, the combination of natural resources and climatic conditions required to support commercial production of microalgal lipids is available only in the Southwest. The carbon needed to produce lipids must be provided to the microalgae as carbon dioxide (CO_2), either in pure form or as a component of flue gases. Competing users - including enhanced oil recovery (EOR) operations - can afford to bid commercially available pure CO_2 away from lipid producers using present microalgal technology. In the Southwest, EOR will be the major user of all available CO_2 for the next 30 to 40 years. After 2020, pure CO_2 will be abundantly available for use in microalgae production. Because flue gas must be used on site and few power plants are located in areas suitable for microalgal growth, this source of CO_2 for microalgae production is unlikely to be significant. The microalgal lipid production systems designed to date will have costs in excess of $75/barrel of oil equivalent (in 1982 dollars) when CO_2 does become available. 35 references, 3 figures, 14 tables.

7352 **(DOE/ER/10000—T3) Development of a solar energy system. Executive summary. Final technical report.** Johnson, E.L. (Texas Instruments, Inc., Dallas (USA). Central Research Lab.). May 1983. Contract FC01-79ER10000. 41p. NTIS, PC A03/MF A01. Order Number DE83014392.

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In the TI solar energy system (TISES) concept, conversion is accomplished by operation of small silicon solar cells immersed in an electrolyte, and the current generated by the cells is used to separate the electrolyte into its constituent parts. These parts can be stored separately until needed and then recombined in a fuel cell to produce electrical energy. The concept encompasses not only the efficient conversion of solar energy (the solar chemical convertor), but also efficient storage and use of converted solar energy and efficient use of materials for that purpose. The system is composed of four main components: the solar chemical convertor (SCC), hydrogen storage, a fuel cell, and a heat exchanger. The only input is solar radiation, and the output is electrical and thermal energy. The goal of this four-year Cooperative Agreement has been to advance the development of the key components (SCC, hydrogen storage, fuel cell, and thermal management system) and integrate them into a development prototype system to demonstrate that the approach is viable and worthy of pursuit to commercialization.

7353 **(DOE/ER/10000—T4) Development of a solar energy system. Final report.** Johnson, E.L. (Texas Instruments, Inc., Dallas (USA). Central Research Lab.). May 1983. Contract FC01-79ER10000. 493p. NTIS, PC A21/MF A01. Order Number DE83014236.

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In the TI solar energy system (TISES) concept, conversion is accomplished by operation of small silicon solar cells immersed in an electrolyte, and the current generated by the cells is used to separate the electrolyte into its constituent parts. These parts can be stored separately until needed and then recombined in a fuel cell to produce electrical energy. The concept encompasses not only the efficient conversion of solar energy (the solar chemical convertor), but also efficient storage and use of converted solar energy and efficient use of materials for that purpose. The system is composed of four main components: the solar chemical convertor (SCC), hydrogen storage, a fuel cell, and a heat exchanger. The only input is solar radiation, and the output is electrical and thermal energy. The goal of this four-year Cooperative Agreement has been to advance the development of the key components (SCC, hydrogen storage, fuel cell, and thermal management system) and integrate them into a development prototype system to demonstrate that the approach is viable and worthy of pursuit to commercialization.

7354 **(DOE/ET/25209—1) Metal oxide anodes for the photoelectrochemical generation of oxygen. Final report, September 24, 1981-September 30, 1983.** Levine, S.; Liou, F.T.; Hakim, K.; Yang, C. (State Univ. of New York, Stony Brook (USA); Brookhaven National Lab., Upton, NY (USA)). 1983. Contract AC02-80ET25209. 157p. NTIS, PC A08/MF A01. Order Number DE84005168.

The present report summarizes work on the metal oxide photoanodes conducted under the present contract. The objective of the program was to develop practical photoelectrodes for use in the photoelectrolysis of water. Evidence is provided for an operative TiO_2/Fe_2O_3 heterojunction anode. As yet unexplained instabilities were observed with TiO_2 anodes when operated in excess of 100 hs. Studies on polycrystalline In_2O_3 indicated photoefficiencies comparable to that of single crystal material. Efforts to improve the efficiency of polycrystalline In_2O_3 by the addition of Y_2O_3 were unsuccessful. Studies were also conducted on solid state electrochemical techniques for doping TiO_2 with fluoride. A 30% increase in efficiency was noted at relatively low levels but a decrease was observed at higher doping levels.

7355 **(DOE/JPL/955567—83/12) Design, analysis and test verification of advanced encapsulation systems. Triannual report for the period ending July 31, 1983.** Garcia, A. III. (Spectrolab, Inc., Sylmar, CA (USA)). Nov 1983. Contract NAS-7-100-955567. 101p. NTIS, PC A06/MF A01. Order Number DE84004732.

The program reported is to develop the analytical methodology for advanced encapsulation designs. From these models design sensitivities will be established for the development of photovoltaic module criteria and the definition of needed research tasks. Work on optical, thermal, and structural analyses of candidate encapsulation systems is reported. From these analyses, as well as an electrical analysis, several candidate encapsulation systems were selected for qualification testing. A module of polyurethane was completed with steps taken to eliminate trapped bubbles. (LEW)

7356 (INIS-mf—8664, pp 60) **Preparation and characterization of II - VI compounds for solar cells.** Sitter, H.; Humensberger, J. (Johannes Kepler Univ., Linz (Austria)). 1982. (In German). NTIS (US Sales Only), PC A05/MF A01. (CONF-8209185—).

From Annual conference of the Austrian Physical Society; Graz, Austria (22 Sep 1982).

7357 **(NE—1983-1) Forest Energy Plantations on Forest Sites. IEA Programme of research, development and demonstration on forestry energy.** Mitchell, C.P.; Puccioni-Agnoletti, M.C. (eds.) (Aberdeen Univ., Aberdeen (United Kingdom)). (Naemnden foer Energiproduktionsforskning, Stockholm (Sweden)). Feb 1983. 31p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84750092.

The report considers the silvicultural methods available and the management of forest sites for energy as part of a programme organized by IEA.

7358 **(NE-EO—83-1) Experiments of fertilization and irrigation at the cultivation of energy forest. Annual report 1981.** Elowson, S.; Rytter, L. (Naemnden foer Energiproduktionsforskning, Stockholm (Sweden)). 1982. 22p. (In Swedish). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750098.

The following investigations are reported: inventory of new plantations at Stormuren; sampling of biomass and the analysis of fertilizers; frost damage of Salix-clones; mapping of Salix and Alnus; the effect of the pH of the soil on Salix; inventory of the stump suckers of grey alder; and peat analysis of Stormuren.

7359 **(NE-EO—83-4) Effect of the time of the cutting down on the productivity of Salix.** Loefgren, P. (Naemnden foer Energiproduktionsforskning, Stockholm (Sweden)). 1982. 22p. (In Swedish). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750099.

The effect of the cutting down on stools has been investigated. A possible reduction of the reproductivity may take place after cutting down in mid-April. When cutting down is made after mid-May, the reduction is drastic. Cuttings made from the middle of November to May have no consequence on the survival of the cuttings.

7360 **(NE-EO—83-5) Frost damage in energy forestry. Analysis of the problem and plan for future work.** Christersson, L.; von Fircks, H.R.; Sennerby-Forsse.L. (Naemnden foer Energiproduktionsforskning, Stockholm (Sweden)). 1982. 17p. (In Swedish). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750100.

Energy forestry is restricted to land which cannot be utilized economically for agriculture and silviculture. Frost during the growing season is a major problem for biomass production in these areas and in Sweden there are thousands of hectares of this type of land. Most promising results in these areas have been obtained with species and clones of the genus Salix and Populus. Some field observations and a few results of preliminary tests are dealt with. The problems of frost damage are discussed and plans for future work are presented.

7361 **(NE-EO—83-7) Fenix VBB.** Engstroem, L.; Hedman, G.; Lundberg, H. (Naemnden foer Energiproduktionsforskning, Stockholm (Sweden)). 1982. 114p. (In Swedish). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84750105.

Short rotation energy forestry and/or the cultivation of reed for energy purposes on dried-out peat-bog bottoms may allow con-

tinued fuel extraction from a certain bogland area. Until July 1982, 35 concessions for peat exploitations on a total area of 12.000 hectare had been granted in Sweden. In July 1982, 252 applications for investigation concessions were registered. The total area of peat bogs involved in this case is 120,000 hectare. Peat is planned to be used in facilities with a total capacity of 1,200 MW and wood chips will be used for another 1,650 MW, both figures including plants for combined power and heating. The formation processes of peat-bogs are outlined and the importance of the degree of humification in the bottom layers is stressed. Drainage, plantation, stump extraction, spreading of lime, deep cultivating and manuring are pointed out as the most necessary measures to be taken before the plantation of energy forest cuttings. Altogether it is estimated that the establishing costs of a short-rotation sallow-cultivation would be 15,000 SEK/hectare on a peat-bog bottom after sod or milled peat harvesting and 20,000 SEK/hectare after full-depth excavation . An important conclusion is that sod peat harvesting on large bogs in many cases will make areas suitable for short rotation forestry accessible at relatively early stages of the harvesting process. The question of drainage through pumping in connection with sod peat harvesting is discussed. The main environmental impact of peat harvesting is changes in the hydrological balance. The report includes a summary of the accessible knowledge in the case of reed cultivation for energy purposes. This knowledge has been applied to the studies of the three projects in Smaaland. Finally the report discusses claims that may be raised in the case of dried-out peat-bogs.

7382 **(NE-EO—83-9) Weed control of growing stands of energy forests.** Noren, O.; Danfors, B.; Stambeck, A. (Naemnden foer Energiproduktionsforskning, Stockholm (Sweden)). 1983. 51p. (In Swedish). (JTI—48). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84750101.

Investigations that would lead to the selection of suitable methods of weed control in growing stands of energy forests were started. Different methods of accomplishing the weed control measures, i.e., both mechanical and chemical methods must be available. The mechanical measures can be done either with powered or nonpowered tillage implements. The chemical weed control will require special techniques and equipment. As regards mechanical weed control, a tool-bar was built upon which different tillage units could be attached. Weed control with non-powered tillage implements gives best results on mineral soils. On orgnogenic soils the degree of humification and the number of weeds are decisive for the result. The tool-bar was also used to test ground-driven discs, diameter 520 mm. These work well under most conditions and can also be used on organogenic soils with abundant growth of weeds. The placement of the implement, preferably in two parts, one in front and one at the rear of the tractor permits greater precision to be achieved when driving at the same time as the implement can be slightly more roomy. On organogenic soils a rotary cultivator often gives good results in weed control. Where the weed growth was too dense leaves and stems became entwined around the axles. On low-humified soils residues of roots and stumps caused problems. The bulletin discusses weed-wiper technique as well as spraying, and different technical solutions are proposed. In order to achieve effective mechanical or chemical weed control it is necessary to place high demands on the precision in the planting of the cuttings. Another requirement that arises in different situations is the accessibility. Machinery and vehicles must be designed so that they can be fitted with suitable wheel equipment or tracks that provide better carying capacity. Long-term soil compaction can also be reduced if the wheel equipment is suitably designed.

7383 **(NE-EO—83-10) Large scale trials NORD. Stage 1, the organization of experiments.** Andersson, G.; Eriksson, S.; Hedman, G. (Naemnden foer Energiproduktionsforskning, Stockholm (Sweden)). Mar 1983. 105p. (In Swedish). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84750102.

The detailed planning of large-scale practical cultivation trials with energy forests in Vaesterbotten in the north of Sweden has been carried out. The aim of the trials is to study the use of energy forests on a practical scale, from selection of land to final use of the energy raw materials obtained. The intention is to conduct the trials on abondoned agriculture land and marshland. The areas together cover some 100 hectares. In the case of extensive cultivation, the preparatory measures will be limited to chemical weedkilling and ploughing. In the case of extensive cultivation on marshland (Bullmyran), part of the surface area will be fertilized with wood ash, and part with ordinary commercial fertilizer. It is estimated that intensive cultivation will have a rotation of about 5 years. In the case of extensive cultivation, rotation will be very much longer, some 15-30 years. In order to provide a basis for optimization of energy forest systems, a number of limited trials have been linked to the large-scale trials, in order to study alternatives to the methods applied in the main trials. An ongoing trial period of, 3 times 3 years, is considered sufficient in spite of the fact that rotation in the case of extensive cultivation is considerably longer than this. The first three-year period will mainly include preparatory measures and the planting of stands. The second three-year period will to a large extent be concerned with care of the stands and production follow-up. During the third three-year period, it is planned to harvest the intensively cultivated energy forests. It is calculated that in existing stands harvesting will take place in all of the three-year periods. The cost of the trials is estimated during the next three years to be as follows: 1983 SEK 2.2 million. 1984 SEK 1.0 million. 1985 SEK 1.2 million. The cost will amount to SEK 0.6 million per annum during the second three-year period.

7384 **(NE-FBA—83-6) Pure forest fuel. Development of existing and new techniques of fractioning and purification of forest fuels.** Stridsberg, S. (Naemnden foer Energiproduktionsforskning, Stockholm (Sweden)). Jan 1983. 101p. (In Swedish). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84750103.

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The paper presents a basic study of the present situation concerning the quality of wood fuel. The possibilities of developing harvesting methods and the processes for fractioning, cleaning and drying are assessed. The determination of the distribution of fractions from various wood fuels, e.g. trees, logging residuals, bark etc. is described. The content of moisture and ash has been investigated. The requirements for new processes have been determined. The standard quality of wood chips is composed up to 20 percent of a fraction smaller than 12 mm. The chips of branches and twigs are to 40 percent smaller than 12 mm and 20 percent are below 6 mm. The logging residuals give almost 60 percent below 12 mm. The ash content is also higher for the fine fractions: logging residues contain 75 percent of the total ashes. The coarse fraction, larger than 100 mm comes from trees and logging residures and amounts to 4 to 6 percent.

7385 **(ORNL/TM—8566) FIRSTCUT: a preliminary assessment model for short-rotation intensive silviculture. Model description and user's guide.** Barron, W.; Perlack, R.; Kroll, P.; Cushman, J.; Ranney, J.W. (Oak Ridge National Lab., TN (USA)). Nov 1983. Contract W-7405-ENG-26. 176p. NTIS, PC A09/MF A01. Order Number DE84004132.

FIRSTCUT is an interactive simulation model which calculates the discounted average cost, net present value and rate of return for short-rotation intensive silvicultural biomass production. The model is intended for preliminary economic feasibility assessments in which the principal analytical objectives are: (1) to analyze the variation in discounted average cost and net present value with respect to specific resource characteristics and economic conditions, (2) to identify the most attractive conditions for sites and designs, and (3) to indicate the nature of potential trade-off relationships in system design and operation. In FIRSTCUT, the biomass system under investigation is defined by a large number of user-specified values. These parameters provide the capability for tracking the implications of changes in major system components separately, while keeping the description of the components general enough to apply to a wide range of plantation systems. Through appropriate specification of the costs of capital equipment, labor, and materials, FIRSTCUT is equally applicable to systems that range from a highly mechanical operation in the United States to a labor-intensive plantation system in a less-developed country. The configuration of user-specified values also determines the roles of the cost of capital, labor, and materials in the investment alternatives. The user-specified values are grouped into six categories: (1) site and scenario descriptors, (2) economic factors, (3) plantation es-

tablishment parameters, (4) operation and maintenance parameters, (5) yield response parameters, and (6) harvesting decisions.

7366 **(SLU-IVL—137) Storing of disintegrated logging residuals.** Thoernqvist, T. (Sveriges Lantbruksuniversitet, Uppsala. Institutionen foer Virkeslaera). 1983. 95p. (In Swedish). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84750094.

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The purpose of this investigation has been to study storage of disintegrated logging residuals (slash) in large piles. The investigation consisted of six substudies. In all the piles with disintegrated logging residuals 15 temperature sensors were placed, around which 7 weighed nylon net bags filled with material representative for the pile. At the conclusion of the study the average dry matter loss at each measurement point was determined. In addition the materials moisture content (by green weight), density, composion, effective heating value and amount of fungal particles was determined before and after storage for each substudy. The temperature in the piles with reduced material raised within several weeks to nearly 70 degreeC in the central and upper areas. For some shorter periods the temparature was over 80 degreeC. The dry matter loss during the storage period for the different sub-studies varied between 0.7 percent up to 3.3 percent per month. For the material which was disintegrated to a smaller sized fraction, one-half as much dry matter loss was registered as with the larger sized fractions. In addition, it was noted that the materials moisture content at the initiation of the investigation appears to be strongly significant in dry matter losses. All six sub-studies show energy losses during the storage period. The highest was registered for the pile with fresh rough disintegrated logging residuals which was covered with a tarpaulin. At the start of the investigation between 10^7 and 10^8 fungi per kg dry matter grew from the substrata used. After storage no more fungi grew from the material in the fine disintegrated material. In the other piles the total fungi which grew up varied from 0 to 10^{10} per kg dry matter.

7367 **(SLU-IVL—138) Measuring of limbs and tops from harvested forests - different methods and their precision.** Roos, K. (Sveriges Lantbruksuniversitet, Uppsala. Institutionen foer Virkeslaera). 1983. 34p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84750095.

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Weighing and volume measuring, as methods for measuring of logging residues (limbs and tops from harvested forests), have been compared with regard to precision. The pre-requisites are compiled from earlier studies of moisture content, basic density, solid volume portion, etc. The scope has been set on measuring of truck loads at industry. Excluding winter time when snow and ice amounts cannot at all be estimated, weighing appears as the most promising method. This applies also to a comparison of cost estimates, where methods that are more expensive than todays pulpwood measuring (e.g require some kind of sampling) must be excluded. Therefore, at a choice of further studies, focusing on the possibility of ocular estimation of moisture content and snow quantities seems to be the most promising. Taking the increasing interest in fuel quality (e.g. moisture content) into account, weighing likewise holds out the best prospects. It shall however be stressed that volume measuring in pile, with presumed values for the solid volume portion and the moisture content, is certainly the cheapest mehtod. For large suppliers, a high accuracy is also obtained in course of time. A more extensive experience of variations in solid volume portion would furthermore enable measuring of piled residues at roadside. Performance rating of off-road extraction in common volume measures would be yet an application. Costs for main haulage, on the other hand, is to a great extent dependent on weight. Weighing could therefore, besides measuring data, also provide a basis for hauling compensation to the transporter.

7368 **(SLU-IVL-UPPSATSER—120) Study of the drying process of trees and tree sections during storage.** Fryk, H. (Sveriges Lantbruksuniversitet, Uppsala. Institutionen foer Virkeslaera). 1983. 25p. (In Swedish). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750096.

The purpose of the study was to illustrate the drying process, under supervised forms, of the assortment unlimbed trees and tree sections during storage. The test was set up at the end of August and the first weighing was carried through on the 24 of August. At that time the moisture content for spruce was 46,7 percent and for the broadleaved 41.4 percent. The final weighing was done in September the following year. At that very occasion the mean moisture content for spruce was 19.8 percent, for pine 28.7 percent and for broadleaved 31.1 percent. Moisture content is falling considerably in the first month to somewhat increase during the autumn. This depending on the effect of sourfelling and on favourable external drying conditions such as a low relative air humidity in springtime and a high humidity in autumn. The wight of the different test stacks decreased by approx. 22 percent for the softwood timber and 17 for the hardwood during the whole trial period.

7369 **Effects of a voltage-dependent light-generated current on solar cell measurements: $CuInSe_2/Cd(Zn)S$.** Eron, M.; Rothwarf, A. (Electrical and Computer Engineering Department, Drexel University, Philadelphia, Pennsylvania 19104). *Applied Physics Letters;* **44**: No. 1, 131-133(1 Jan 1984).

Chopped beam measurements on $CuInSe_2/Cu(Zn)S$ solar cells have revealed a failure of the superposition principle, with the light-generated current showing a strong voltage dependence. The light I-V curve can be fully explained with no change in the diode current. The voltage-dependent light-generated current dominates the light I-V curve below V/sub oc/, requiring that the analysis of all the traditional solar cell characterization measurements be modified. We have derived the general expressions needed to obtain the diode factor from the light I-V and V/sub oc/ versus intensity curves. We have also shown how the temperature variation of V/sub oc/ is affected.

7370 **Solar-hydrogen energy economy: beyond the age of fire.** Skelton, L.W. New York, NY; Van Nostrand Reinhold (1984). 224p. Van Nostrand Reinhold, 135 West 50th Street, New York, NY 10020 $28.95.

From publisher's announcement.

This book not only covers the basic technological principles and structure of a solar/hydrogen energy economy, but also discusses the outline of a model plan for the implementation of such a system. It explains current and potentially available technologies for the conversion of sunlight to energy, energy to hydrogen, and the storage and transportation of hydrogen. A model plan is presented for the implementation of a solar-hydrogen system over the next several decades, addressing the problems and strategies of developing the necessary technology. Useful reviews are included of the basic physical and chemical principles of the system. Step-by-step explanations of the basic operation of a wide variety of solar energy and hydrogen generating and use systems are provided. Among the technologies discussed are photovoltaics-, photobiotic-, and photosynthesis-mimicking conversions, solid polymere electrolyte fuel cells and hydrogen generation systems, metal hydride storage of hydrogen, and many others. This reference source relates these technologies to the broader problem of energy use and distribution through the concept of an energy economy. 31 figures.

7371 **Absorption and emission characteristics of merocyanine 540 in microemulsions.** Dixit, N.S.; Mackay, R.A. (Drexel Univ., Philadelphia, PA). *Journal of the American Chemical Society;* **105**: No. 9, 2928-2929(4 May 1983).

Cyanine dyes are heterocyclic chromophores that are extensively used in a number of areas. For example, they are used as photographic sensitizers, in photographic filter layers, for textiles, and in chemotherapy. Recently they have also been examined as possible candidates for solar energy conversion in the form of monolayers and thin films on glass substrates. The efficiency of the cyanine dyes as photosensitizers depends upon their emission properties and also on their photostability. Unfortunately, it is commonly observed that the cyanine dyes with a polymethine chain in the molecular framework degrade in light. In a recent communication, Humphrey-Baker et al. have shown that both the fluorescence yield and photostability of a cyanine dye are significantly enhanced in anionic micellar solution, and they have attributed it to a microviscosity effect. The absorption and fluorescence properties of merocyanine 540 in anionic and cationic microemulsion are reported. Measurements have also been performed in water, ethanol, 1-pen-

tanol, and aqueous micellar solutions to serve as a basis of comparison.

7372 **Electro-generated conducting polypyrrole polymers and applications in photoelectrochemical cells.** Noufi, R.N. (Solar Energy Research Inst., Golden CO). *Applied Physics Communications;* 3: No. 1 & 2, 33-57(1983).

A major problem in the development of photoelectrochemical cells for solar energy conversion and storage is the susceptibility of small bandgap semiconductor materials to photodegradation. This problem could be overcome, in principle, by protecting the semiconductor electrode surface with electrically conducting polymer film. This film, acting as a barrier to ion/solvent transport, would inhibit photodegradation of the electrode surface while permitting electron exchange with the electrode. Recent studies on the electrogenerated polypyrrole and its applications in photoelectrochemical cells are presented.

7373 **Pathology of solar cell contacts.** Ross, B. (Bernd Ross Associates, San Diego, CA). pp 527-531 of Fourth E.C. Photovoltaic Solar Energy Conference. Bloss, W.H.; Grassi, G. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Company (1982). (CONF-820555—).

From 4. photovoltaic solar energy conference; Stresa, Italy (10 May 1982).

Energy level diagrams of metal contacts to silicon solar cells are examined, as well as equations governing the tunneling conductance. Symptoms of some solar cell contact problems are mentioned and potential diagnoses are suggested. These include the "flat spot" phenomenon and "S" shaped curves along with the more common series and shunt resistance problems, which all result in poor fill factor and consequently lower efficiencies. Examination of recent solar cells provided with screened thick film copper contacts along with controls, indicate that this contact method does not impose an efficiency limitation.

7374 **Promise and status of international applications of photovoltaics.** Altseimer, J.H.; Krupka, M.C. (Los Alamos National Lab., NM). pp 202-204 of 4th Miami international conference on alternative energy sources. Veziroglu, T.N. (ed.). Coral Gables, FL; Univ. of Miami (1982). (CONF-811212—).

From 4. international conference on alternative energy sources; Miami Beach, FL, USA (14 Dec 1981).

7375 **Rules to encourage cogeneration and small power production facilities under the Public Utilities Regulatory Policies Act of 1979.** Cowles, R.L. (US Dept. of Energy, Washington, DC). pp 130-135 of Industrial wood energy forum 81. Madison, WI; Forest Products Research Society (1981).

The briefing provides an overview of the Public Utilities Regulatory Policies Act of 1979 (PURPA) and the energy systems eligible for operation under PURPA's goal is to encourage the deployment of cogeneration and small power production facilities without penalizing the consumer. This is a complex task and subject to continuing change and refinement by federal and state regulators.

7376 **Biomass energy systems program wood energy activities.** Berger, B.J. (Biomass Energy Systems Div., US Dept. of Energy, Washington, DC). pp 3-5 of Industrial wood energy forum 81. Madison, WI; Forest Products Research Society (1981).

The function of the Biomass Energy Systems (BES) program in the Department of Energy (DOE) is to accelerate adoption of cost-effective technologies to produce fuels and petrochemical substitutes from biomass. Of all the solar technologies biomass has the greatest near-term potential for displacing fossil fuels. The goal of the BES program is to establish a technology framework that will encourage a more effective use of wood resources for energy. To reduce impacts of increased biomass energy demand on forest product prices, DOE has worked with U.S. Forest Service, the national laboratories, university researchers, and private industry to identify optimum biomass cultivation practices and harvesting techniques. A further objective of the Biomass program is to develop systems for converting biomass resources through the direct liquefaction of wood.

7377 **Feasibility of a wood fired integrated energy system - Lagrange, Georgia.** Wade, D.W. (Resource Development Associates, 626 Cherokee St., Marietta, GA 30060). pp 111-117 of Industrial wood energy forum 81. Madison, WI; Forest Products Research Society ([nd]).

Under a contract with the Department of Energy and the LaGrange Industrial Development Authority, a feasibility study for the construction and operation of a wood-fired combined heat and power production plant is being conducted in conjunction with the development of the city's 500-acre Industrial Park. Several options are available to system planners, including phasing of the plant in small increments, producing steam as a primary energy source, producing electricity as a primary energy source, and using various local wood resources for fuel. Wood wastes found at wood products industries and sawmills, and residue left in the forest after harvesting are evaluated as a renewable energy source for the central energy plant. Both thermal and electrical energy production are evaluated for cost effectiveness in the LaGrange situation. Alternative fuel sources including coal, oil, and municipal refuse are also being considered as back-up fuel supplies. Key elements of the study include 1) a thorough search of literature concerned with wood as an energy source, wood harvesting techniques, and wood combustion equipment, 2) a technical analysis of the industrial park's energy requirements through a survey conducted by Georgia Tech, 3) development of a design criteria for the central energy system, along with the investigation of alternative energy supply schemes. To avoid any adverse impacts on air and water quality in the LaGrange area, an investigation of environmental impacts will be conducted during the study. In addition, cost analyses including life cycles benefits, operating and ownership arrangements, and alternative financing schemes are explored.

1407 Solar Thermal Power Systems

REFER ALSO TO CITATION(S) 8463

7378 **(DOE/ER/30043—T1) Panel results of the solar thermal program research requirement assessment review. Final report.** (TPI, Inc., Beltsville, MD (USA)). Nov 1983. Contract AC01-82ER30043. 70p. NTIS, PC A04/MF A01. Order Number DE84003758.

The objectives of the assessment were to identify: research needs by topic and activity, relative priority of research needs, options for performing needed research, potential performers, costs and duration of R and D activities, gaps and duplications within the R and D program, and activities underway that appear to be of low priority. To achieve these objectives research programs of the Division of Solar Thermal Technologies within the Office of Renewable Energy and Conservation and the Materials and Advanced Energy Programs of the Office of Basic Energy Sciences were reviewed. Several recent assessments of solar thermal research needs made within the past two years by various groups were also reviewed, and the key research issues and needs were extracted. The primary results from the assessment are a set of prioritized activities to meet the most important research needs for solar thermal technologies. These activities belong to four disciplines: materials science, thermal science, thermochemistry, and engineering. Further, priorities associated with the needs for research result from the various activities allow the recommended activities to be grouped into two categories; a core group which should be at the heart of any future program developed by the department, and a set of important needs that should, at least, find their way into a program at some time during its existence. The recommended research program is outlined, and the complete set of ranked research needs is listed.

7379 **(DOE/JPL—1060-61-Vol.1) Solar thermal technology. Annual evaluation report, fiscal year 1982. Volume I. Executive summary.** (Jet Propulsion Lab., Pasadena, CA (USA)). Jul 1983. Contract AC04-76DP00789. 33p. (JPL-PUB—83-60-Vol.1). NTIS, PC A03/MF A01. Order Number DE84003926.

This report, which is divided into two volumes, documents the accomplishments and progress of the US Department of Energy Solar Thermal Technology (STT) Program during FY 1982, covering the period from October 1, 1981 to September 30, 1982. The focus of the STT Program is research and development leading to the commercial readiness of three primary solar thermal concepts: the central receiver, parabolic dish, and parabolic trough. To a lesser extent, the hemispherical bowl and salt-gradient solar pond are also being studied. This development effort is complemented by numerous research and planning activities. Volume I, the Executive Summary, contains a brief description of each technology and highlights of the fiscal year's technical activities.

7380 **(DOE/JPL—1060-61-Vol.2) Solar thermal technology: annual evaluation report, fiscal year 1982. Volume II. Technical.** (Jet Propulsion Lab., Pasadena, CA (USA)). Jul 1983. Contract AC04-76DP00789. 167p. (JPL-PUB—83-60-Vol.2). NTIS, PC A08/MF A01. Order Number DE84003929.

This report, which is divided into two volumes, documents the accomplishments and progress of the US Department of Energy Solar Thermal Technology (STT) Program during FY 1982, covering the period from October 1, 1981 to September 30, 1982. The focus of the STT Program is research and development leading to the commercial readiness of three primary solar thermal concepts: the central receiver, parabolic dish, and parabolic trough. To a lesser extent, the hemispherical bowl and salt-gradient solar pond are also being studied. This development effort is complemented by numerous research and planning activities. Volume II details FY 1982 accomplishments and includes a bibliography, list of contacts, acronyms, and definition of terms relevant to solar thermal technology and the STT Program.

1408 Ocean Energy Systems

7381 **(IVL-B—709) Environmental consequences of energy extraction by Ocean Thermal Energy Conversion (OTEC).** Jerneloev, M. (Institutet foer Vatten- och Luftvaardsforskning, Stockholm (Sweden)). Nov 1982. 45p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84750093.

OTEC makes use of the temperature difference between warm surface water and cool bottom water. The difference must exceed 20 degreeC. As large water volumes must be circulated, there will be destruction of organisms, redistribution of gases, release of biocides and metals. Other problems and conflicts are referred to. A liteature list is included.

1409 Solar Thermal Utilization

REFER ALSO TO CITATION(S) 7766, 7768

7382 **(BMFT-FB-T—83-171) German-Indian cooperation program for solar powered water pumps. Phase I.** Mukherjee, T.K.; Santhanam, V.C.; Syed, B.A.; Schneller, D.; Speidel, K. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Aug 1983. 67p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84750045.

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This solar powered water pump is an improved version of an already existing prototype and is foreseen to be applied in remote villages in India. The main application of this facility is pumping water from deep wells (up to 100 m). The function principle corresponds to a Rankine cycle, where solar energy generates vapor and this energy is finally transfered to mechanical one to be used for water pumping. The aim of the whole cooperation program is the production and application of such pumps in India. The test facility has been installed in Hyderabad in May 81 and is running without problems; about 900 Working hours have been performed up to the end of 1981 under realistic test conditions with solar energy. First test results indicate a daily pumping rate of 20-45 m^3/day due to the solar radiation intensity with a collector field installed of about 28 m^2.

7383 **(CAPE—2910) Solar research and office building (Engineering Materials).** (Alabama Power Co., Birmingham (USA)). 31 Aug 1976. Contract AC03-76CS32400. TIC, PO Bx 62, Oak Ridge, TN 37831.

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In 1975 , Alabama Power Company, as part of a complete energy conservation program to promote the utilization of solar energy heating/cooling systems, completed the design of a solar-assisted, heated and cooled, district office building located in Montevallo, Alabama. The Alabama Power Company Montevallo district office solar project serves three basic functions: (1) fulfills the requirements which have been established for district level operations; (2) serves as a demonstration regarding the utilization of an integrated commercial solar heating and cooling and hot water heating system; and (3) serves as an energy conservation research project which will provide data to be used in expanding the company's load research data base. The building is used for typical district office operations within the Alabama Power Company service area - namely, to satisfy functional space requirements for the accounting, marketing, operating and appliance service departments. Provisions have also been made for displaying appliances and an auditorium is available for company and customer training programs and also for public and civic activities. These drawings accompany report No. DOE/CS/32400-T1.

7384 **(DOE/R4/10142—T1) Community Greenhouse Project, Guilford County, North Carolina.** Clark, W. (Coalition for Safe Energy, Greensboro, NC (USA)). [nd]. Contract FG44-80R410142. 8p. NTIS, PC A02/MF A01. Order Number DE84000285.

The original goal of this grant was to locate sites for a community greenhouse project in Guilford County, North Carolina, and to develop programs to be carried out at the greenhouse. These would demonstrate the values of a community growing space, general neighborhood cooperation, and different methods of saving energy, collecting solar energy, and recycling human and material energies. While the site-oriented approach turned out to be very attractive, it had many inherent costs and obstacles not appreciated by the original grant proposal committee. Some of these are discussed in this report.

7385 **(DOE/R4/10152—T1) Miami-Dade Community College: urban aquaculture project. Final report.** (Masiko (Peter), Miami, FL (USA)). [nd]. Contract FG44-80R410152. 18p. NTIS, PC A02/MF A01. Order Number DE84000749.

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A small-scale (1,000 gallon), low energy (350-1,000 watts hours/week), closed catfish aquaculture system was built and received initial testing at the Miami-Dade Community College Environmental Demonstration Center. The design was modified in the course of the project based on preliminary findings and operational experience. Although the grant period ended before any catfish reached maturity, preliminary results indicate that this is a viable system that may be widely replicated for less than $600 in areas with at least a seven-month growing season. Estimated production is 25 to 35 pounds of catfish per growing season (every seven months).

7386 **(DOE/R6/10960—T1) Design of a one-way heat shield. Final report.** Duncan, L.S. (Duncan (Laura S.), Austin, TX (USA)). [nd]. Contract FG46-79R610960. 51p. NTIS, MF04/MF A01. Order Number DE84003131.

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The object of this project was to seek to develop a shield that would pass radiant energy preferentially in one direction, thereby creating a temperature differential between the two sides of the shield. This shield was made out of crystals of rock salt which had been ground into the shape of hollow hemispheres, polished, and arranged in one or more flat layers. The shield was then placed over the bulb of a thermometer, and the temperature of this thermometer was compared with that of a control, which remained uncovered. The complete procedure for making and testing this shield is described. The best results were obtained when very clear,

highly polished crystals were used. In these trials, the experimental thermometer cooled off or warmed up an average of about 1°F. A statistical analysis showed that the results were highly significant, in spite of the small change in temperature.

7387 **(DOE/R6/10966—T1) Natural circulation solar heated lumber drying kiln.** Vincent, J.; Cook, R. (Vincent (John R.), San Juan Pueblo, NM (USA)). [nd]. Contract FG46-79R610966. 35p. NTIS, PC A03/MF A01. Order Number DE84003550.

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A low cost, low technology solar heated kiln dryer for lumber was designed, constructed and evaluated. It was found that the facility was effective in drying ponderosa pine in 60 to 85 days utilizing natural circulation. A low technology steam generator was constructed and used in the stress relief treatment of the kiln dried lumber. The dried and stress relieved lumber was evaluated by several user-craftsmen and a written defect report was obtained and the results summarized in a data table. The project was satisfactorily completed and the feasibility of the concept was supported by the results.

7388 **(DOE/R6/10971—T1) Evaluation of the performance characteristics of a hybrid Trombe wall using steel rods and concrete.** Merewether, D.E.; Jablonski, J.R. (Electro Magnetic Applications, Inc., Albuquerque, NM (USA). Solar Div.). 15 Nov 1980. Contract FG46-79R610971. 42p. NTIS, PC A03/MF A01. Order Number DE84003451.

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A principal drawback of passive solar systems is the large temperature swing observed over a twenty-four hours period. Several methods have been proposed and used to enhance the immediate transfer of high temperatures on the outer surface of Trombe walls to the interior living areas. These methods include convective circulatory systems and fan forced air circulation. The work reported here examines the addition of metal rods imbedded horizontally in the mortar of an unvented Trombe wall to offer a conducting path between the outer and inner surfaces. It was felt this technique would help decrease the periodic temperature swings as well as enhance the overall thermal performance of the Trombe wall.

7389 **(DOE/R6/10973—T1) Variable collector-to-storage ratio. Final technical report.** Burr, D.S. (High Technology Associates, Fronton, TX (USA)). 31 Mar 1981. Contract FG46-79R610973. 13p. NTIS, PC A02/MF A01. Order Number DE84003494.

The main objective of this project was to develop and demonstrate a simple means of varying the storage volume in an active residential solar heating system by using a 2 cell storage strategy. The purpose was to explore the practicality of changing the collector-to-storage ratio in response to the varying amounts of insolation received throughout the collection day. The intent was such that at the beginning of each day a minimum predetermined volume (150 gallons) of storage medium, in this case water, would be available for heating and once that quantity was brought to an acceptable temperature it would be supplemented in temperature controlled increments until such time as collection ceased. Collection would stop at the onset of a cloudy condition and therefore might be intermittent throughout the day. The rate of supplementation would be controlled so as to keep the temperature in the primary storage cell, cell A, more or less constant until its maximum capacity of 300 gallons was reached. The advantage of the variable storage feature is that it allows the storage temperature to reach a minimum useful level even on marginal collection days thus permitting at least some benefit to accrue where none would be likely had the maximum volume been presented to the collectors from the start of the day. It was considered essential, as a secondary objective, to keep the electrical controls and plumbing simple, even crude, in order for such a scheme to be practical and cost effective.

7390 **(DOE/R6/10976—T1) Jicarilla Apache Tribe: greenhouse renovation and demonstration project. Final technical report.** Martinez, L. Jr. (Jicarilla Apache Tribe, Dulce, NM (USA). Community Action Program). 30 Sep 1980. Contract FG46-79R610976. 13p. NTIS, PC A02/MF A01. Order Number DE84003490.

This report describes briefly the construction phase, instructional phase, bedding plant phase, and tomato production phase of a passive solar greenhouse renovation and demonstration project. Some data on the performance and heat savings are included.

7391 **(DOE/R6/10978—T1) Solar rice drying by contact moisture transfer. Final report.** (Board of Trustees, Fayetteville, AR (USA)). [nd]. Contract FG46-79R610978. 26p. NTIS, PC A03/MF A01. Order Number DE84002966.

The objective of this project was to demonstrate the feasibility of using a secondary drying medium to dry rough rice while drying the secondary medium with solar energy. In particular, glass beads were proposed as a possible secondary medium. Laboratory tests were made to determine the efficiency of the glass beads, sodium chloride, and silica gel as possible secondary drying mediums. Of the three, sodium chloride was best. The glass beads rated almost zero in drying efficiency although possessing excellent wear and drying properties. The silica gel decomposed into dust during agitation. The sodium chloride had good drying properties but caused excessive contamination of the rice. Thus, none of the mediums were deemed practical for field use. Concurrent with the laboratory tests, a concentrating trough-like solar collector was designed and constructed. The University completed a solar site during the last month of the project and made the facility available to the project. Several site measurements were made but for the reasons given, no complete system tests were conducted. The technique of using a secondary drying medium should yield excellent results if a good medium can be found. For this reason, it is recommended that studies be made to determine a good secondary medium for drying rice and other temperature sensitive crops or even materials.

7392 **(DOE/R6/10983—T1) Utilization of solar energy for sludge drying beds.** (Jefferson Parish Water Dept., LA (USA)). May 1982. Contract FG46-79R610983. 118p. NTIS, PC A06/MF A01. Order Number DE84002968.

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The present work is aimed to assess experimentally solar heated drying beds located in the New Orleans, Louisiana Metropolitian Area. An appropriately designed solar system was set to operate on a fibre glass covered drying bed. Another open drying bed was left without solar heating for comparative purposes. Five experimental runs were conducted over a one year period to account for all weather conditions. Aerobically digested waste activated sludge was utilized in the experiments. Experimental results indicated an average reduction of about 50% in the drying period of sludge to attain a total solids concentration of 30% and a corresponding average reduction of about 60% in the drying period of sludge to reach total solids concentration of 60% by solar heating application. Sludge of total solids content of more than 90% was produced in an average period of 20 days under the solar drying process. Solar energy effect was analyzed and discussed using local weather data that prevailed during the experiments. Economic studies were conducted to determine the break even point for the feasibility of the solar drying technique as compared to that of the conventional drying method taking into consideration various cost conducive factors such as land, sludge haulage, operation, maintenance, and material costs.

7393 **(DOE/R6/10984—T1) Integrated passive solar caliche building. Final report.** (Carrizo Springs, City of, TX (USA)). [nd]. Contract FG46-79R610984. 18p. NTIS, PC A02/MF A01. Order Number DE84003493.

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The objectives for this building were to utilize a combination of indigenous resources for the purpose of resource conservation and the potential for long term job production if similar building procedures were incorporated in the region. Specific objectives were the following: the testing of local caliche soils to determine their usability as a stabilized building material; the use of clear night sky as a heat sink for a roof radiant cooling system using the building slab as heat storage; the use of exterior insulation made of local materials to help hold constant temperature within building's caliche mass summer and winter; the use of bamboo species as reinforcing within the foundation of building; to develop a series of water conservation measures for the building; to build a data col-

lection system to monitor the building summer and winter for one year; to transfer these building technologies to local labor.

7394 **(DOE/R6/10988—T1) Solar energy teaching lab with large scale working model.** (John Brown Univ., Siloam Springs, AR (USA). Div. of Engineering). Jan 1981. Contract FG46-79R610988. 26p. NTIS, PC A03/MF A01. Order Number DE84002970.

An active solar energy retrofit has been added to an engineering building at John Brown University. A new system dependent evaluation procedure incorporating the f-chart method was used for panel selection. The system is designed and instrumented in order to provide various laboratory experiences and data acquisition capability. Data accumulation and system control are provided by a microcomputer. The design and performance data will be used to help designers in the geographic region.

7396 **(DOE/R6/10990—T1) Trombe wall retrofit. Final performance report.** Wilson, A. (New Mexico Solar Energy Association, Santa Fe (USA)). 29 Oct 1979. Contract FG46-79R610990. 7p. NTIS, PC A02/MF A01. Order Number DE84003533.

The project involved the construction of two Trombe wall systems to be attached to a residential building for mentally retarded persons. The construction and information phases of this project are briefly discussed. The thermal analysis and load calculations are attached.

7398 **(DOE/R6/10992—T1) Solar and weatherization education for appropriate technology: a community barn raising. Final report. Department of Energy small grants program.** Ferrell, J. (Oklahoma Electric Cooperative, Norman (USA)). [nd]. Contract FG46-79R610992. 13p. NTIS, PC A02/MF A01. Order Number DE84003531.

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The project consisted of two workshops which were open to the general public and those interested in building a low-cost, easily constructed and maintained solar water heating system. The two workshops were jointly sponsored by Oklahoma Electric Cooperative, a local community action program and a non-profit educational organization. Two homes were chosen which belonged to the elderly or low-income homeowners who met income guidelines. Each home was insulated, caulked, weatherstripped and had storm windows installed by workshop participants. The participants learned how to construct and install two low-cost solar water heating systems from readily available materials. One system was a direct gain type, while the other was to operate on a thermosiphon principle. The participants were encouraged to explore how their knowledge might be applied to their homes and others in their communities. Upon selection of the two sites, Oklahoma Electric Cooperative performed an Energy Conservation Assessment, a computerized analysis of the structure's hourly heat loss. Upon completion of the Energy Conservation Assessment, Sunspace workshops conducted an engineering study leading to the design of a solar water heating system for each site.

7397 **(DOE/R6/10996—T1) SLU Plant Science Club passive solar greenhouse. Final technical report.** (Southeastern Louisiana Univ., Hammond (USA). Coll. of Business). Jun 1982. Contract FG46-79R610996. 9p. NTIS, PC A02/MF A01. Order Number DE84003492.

A 20 ft. x 48 ft. passive solar greenhouse with a 39° 57' 12" south roof slope was designed and constructed. A brief description of the project is given.

7398 **(DOE/R6/10998—T1) Solar community appropriate technology house. Report on Phase II of the monitoring program.** (Sunspace, Inc., Ada, OK (USA)). [nd]. Contract FG46-79R610998. 21p. NTIS, PC A02/MF A01. Order Number DE84003549.

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The first phase of the project consisted of reworking a typical house of the sort occupied by many of Oklahoma City's low-income residents so that it made minimum use of energy in general and maximum use of solar energy. After the systems were installed and operating, some inexpensive monitoring systems were installed to collect data about how they were working. The analysis of the data collected during the first year of this project indicated that some of the systems were not working as well as expected. It was decided to continue the project for an additional few months in order to correct some of these problems. While this work was going on, Oklahoma City Community Action (OKC CAP) gathered more data on the performance of the underground air cooling system, and, once modifications on the solar water heater were complete, on the water heater. The present report analyzes these data that OKC CAP collected. Briefly, the analysis shows that: (1) the computer program developed to model the performance of underground cooling systems (earth-air heat exchangers) did an excellent job of predicting the performance of the system built as part of this project. This success suggested that the computer simulation model might be of use to other people and organizations working with earth-air heat exchangers. Unfortunately, although the model was successful in predicting system performance, the system did not provide sufficient cooling to meet the demands of an Oklahoma summer. This report discusses this problem and outlines the conditions under which an earth-air heat exchanger system might make economic sense; and (2) modification of the solar water heater dramatically improved its performance. Before the reworking of the unit, daily high water temperatures were in the range of 90° to 100°F. After the reworking the water regularly reached temperatures approaching 150°F.

7399 **(DOE/R6/10999—T1) Passive solar retro-fit, multipurpose community center.** (Harambee, Inc., Oklahoma City, OK (USA)). 23 Apr 1981. Contract FG46-79R610999. 34p. NTIS, PC A03/MF A01. Order Number DE84003542.

An appropriate technology monitoring evaluation is given for a project to retrofit a solar greenhouse to a community center in Okalahoma. Progress on the construction is evaluated, and the management and bookkeeping for the project are very briefly described. Appended are correspondence and financial documents related to the project. (LEW)

7400 **(DOE/R6/11991—T1) Active solar wood drying kiln. Revised final report.** Alexander, J. (Walnut Fork Design, Builders, and Woodworking Co., Inc., Ozone, AR (USA)). 7 Dec 1982. Contract FG46-80R611991. 5p. NTIS, PC A02/MF A01. Order Number DE84003120.

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This report consists of a brief correspondence on the physical description, theoretical reasoning, instrumentation, and problems concerning the construction of a solar wood drying kiln. The collectors are five Kalwall double glazed 4' x 8' panels.

7401 **(DOE/R6/11997—T1) Ozark food co-op solar greenhouse workshop. Final report.** Henry, J. (Henry (Joseph), Fayetteville, AR (USA)). [nd]. Contract FG46-80R611997. 3p. NTIS, PC A02/MF A01. Order Number DE84003235.

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The performance of the Ozark Food Co-op Solar Greenhouse is briefly reported. Inadequate heat transfer between the greenhouse and the building, resulting in an overheated greenhouse, was remedied by installing a small thermostatically controlled fan blowing air into the building. Bedding plants were planted in mid-February, thrived, and were sold in the spring. (LEW)

7402 **(DOE/R6/12000—T1) Solar pond. Final report.** Kreul, B.H. (Kreul (Bernard H.), Nashville, AR (USA)). 23 Apr 1981. Contract FG46-80R612000. 26p. NTIS, PC A03/MF A01. Order Number DE84003537.

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The purpose of this project was to design, construct, operate, and test a prototype solar collector, thermal storage, and heat exchange system. This system was named a Solar Pond due to its configuration, but should not be confused with the salt brine pond system of the same name. This prototype system consists of a closable reflector top, horizontal plate collector integral with a 3000 gallon water storage pit; and simple pumps, piping, heat exchangers, and automatic controls necessary for operation. The application was to provide heat for an existing 3000 sq ft greenhouse presently

being heated with natural gas as fuel. It was desired to design a system; technologically simple, low in cost, one that could be scaled up to a specific need, and one that could be constructed with locally purchased materials by non-skilled or semi-skilled workers. The total project cost was $2361.00, including design fees, transportation, etc. It is estimated that when scaled up, the cost per Btu could be significally reduced. The projected annual net heat production (over the 6 month heating season) is approximately 28 million Btu's. At current gas rates, this will result in an approximate annual savings of $157.93. Were the fuel source butane, propane, fuel oil, or electricity, the savings would be several times greater.

7403 **(DOE/R6/12024—T1) Design and testing of two innovative passive solar water heaters. Final report.** Burns, V. (Taos Solar Energy Association, NM (USA)). [nd]. Contract FG46-80R612024. 24p. NTIS, PC A02/MF A01. Order Number DE84003132.

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The work is based on designing, constructing, testing, and modifying several prototypes of two solar water heaters. The theoretical function of both the Bottom Loading (BL) and the Self-Insulating Water Wall (SIWW) is described in the proposal. Prototype development is described in more detail in the quarterly reports. A narrative of the functions and the construction modifications is described in this report under Mechanical Design-Photo Descriptions. Performance is described in this report under Experimental and Conclusion. The criteria of building each from common materials for a cost of $200 to 300 has been maintained. Both heaters were tested outdoors in the winter conditions of Taos and did not freeze. Although some of the charts of '82 seem contrary to this statement, there is evidence of electronic failure in the strip chart recorder during this period. Extended testing during '81 and '82, and physical observation allows the statement that useable hot water is available from each during clear sunny day conditions, with value as a pre-heater during periods of cloudy, cold weather. Although neither model is considered optimized, the BL is the preferred model after having analyzed the performance, construction, and safety of each.

7404 **(DOE/R6/12038—T1) Passive solar retrofit and community education package for a multi-use commercial building.** Robison, J. (Robison (John), Oklahoma City, OK (USA)). [nd]. Contract FG46-80R612038. 22p. NTIS, PC A02/MF A01. Order Number DE84002432.

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The project had three objectives. The first goal was to demonstrate proven solar technologies in a community which was busily outlawing windows in new construction. The second goal was conservation of natural gas and electricity used by the building. The third and final goal was educational. To that end, Seminars and workshops were conducted on subjects ranging from weatherization to solar heat and passive cooling. These seminars are being continued with hundreds of participants annually. In addition, public presentations have been made on site, in colleges, universities and junior colleges in Oklahoma, the Oklahoma Energy Expo, and several festivals and open houses on the Paseo. As a biproduct of this effort, several topic specific workbooks and slide presentations were developed and an extensive library has been made available to the public in the Soft Path Reading Room. The project included a roof top sunspace, an air destratification system, a domestic hot water system and a monitoring system. The performance of these systems is discussed and photographs of the systems are included.

7405 **(DOE/R6/12040—T1) Edaphosol heating and cooling system. Final report.** Bohlmann, J.W. (Bohlmann (James W.), Collinsville, OK (USA)). [nd]. Contract FG46-80R612040. 90p. NTIS, PC A05/MF A01. Order Number DE84003532.

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This report consists of diagrams, tables, graphs, and handwritten conclusions from a solar heating and cooling project for a house trailer.

7406 **(DOE/R6/12042—T1) Earth storage of solar heat. Final report.** Garst, P. (Garst (Perry), Quinton, OK (USA)). 19 Apr 1982. Contract FG46-80R612042. 16p. NTIS, PC A02/MF A01. Order Number DE84003453.

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The purpose of this project was to demonstrate that large quantities of heat could be collected and stored by modifing large buildings such as those commonly found on farms. The basic idea was to install a solar collection system on the south roof of such a building and store the heat collected in the earth under the building. To implement the project, a pole type sheet metal building was constructed. The size of the building was 20' x 40'. The peak of the roof ran down the 40' dimension and was offset from the center line so that the roof surface facing south was larger than that facing north. The collector was built on the south side by first constructing a roof of sheet metal with 2-1/2" corrugations. The sheet metal was painted with flat black paint to absorb the solar heat. A space was created over the sheet metal roof by nailing 2 x 4's spaced 2' apart to it. Corrugated fiberglass sheets were nailed to these 2 x 4's to make the collector cover. At the top of the roof, a distribution pipe made of 3/4" CVCP plastic pipe with 1/8" holes to match the corrugations of the sheet metal was installed. A gutter was installed at the bottom to collect the heated water which flowed down the sheet metal. The collector roof and the gutter were insulated with 6" fiberglass batts to complete the collector. Instrumentation, cost, and performance results are discussed.

7407 **(DOE/R6/12044—T1) Economic feasibility of solar energy for medium and low income housing. Final report.** (Young (Fred L.), Midwest City, OK (USA)). [nd]. Contract FG46-80R612044. 17p. NTIS, PC A02/MF A01. Order Number DE84003449.

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Eight collectors totaling 192 sq ft were installed on a solar storage lean-to constructed on the south side of a three bedroom frame home with 860 sq ft floor space. The aim was to demonstrate that efficient solar heating systems can be constructed by the do-it-yourself home owner at minimum cost and have a relatively short payback period. The collectors performed more efficiently than was originally predicted. The original collector efficiency was calculated at 23%, however, measured efficiencies of the collectors in actual operation were 36 to 40%. The system has no difficulty maintaining home temperatures at 70 to 72°F over a 24 hour period following a clear day. The system is considered an excellent approach to reducing energy costs for homeowners. The material costs for the system are very low in comparison to on the market systems. The solar collector performance and quality of construction are equal to or better than off the shelf collectors of the same type, however, the manhours commitment required to construct this system is rather large and may prove the major obstacle in its general acceptance until energy costs increase significantly.

7408 **(DOE/R6/12051—T1) Model for early solar energy education. Final report.** Warmann, S.R. (Travis Elementary School, Odessa, TX (USA)). Jan 1982. Contract FG46-80R612051. 42p. NTIS, PC A03. Order Number DE84002967.

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The sixth grade students at Travis Elementary School in Odessa, Texas built a solar energy system that heats the water for their classroom sink and provides about 50% of the space heating in their room. The students built a bank system of four 3' x 10' plate collectors and installed them on the roof of their school with a piping system flowing to a 218 gallon water storage container located within the classroom. A heat exchanger in the storage tank discharges hot water directly to a faucet in the classroom. To provide heat to the classroom a pump draws heated water through a piping system to a hydronic coil. A blower fan draws room air over the hot coils to heat the room. Eutectic salts in plastic containers are used in the storage tank to maintain the temperature of the heated water. Sensors are integrated into the system at the storage tank and collectors to automatically turn the system on and off. Besides developing vocational, mathematic, and scientific skills, the sixth grade students developed communication skills by presenting the project to various organizations and schools in the community.

7409 **(DOE/R6/12052—T1) Retrofitting an existing residence with an air collector solar heat system. Final technical report.** (Teske (C.E.), Lubbock, TX (USA)). [nd]. Contract FG46-80R612052. 9p. NTIS, PC A02/MF A01. Order Number DE84003144.

This project was to demonstrate the effectiveness of retrofitting an existing home with an inexpensive, site built, wall mounted air collector system. A steel absorber, with air passing between the absorber and the house brick wall, framed in wood, was attached to the south wall of a typical brick home in Lubbock, Texas. The goals of the project were: (1) demonstrate the adaptability of this collector system to a large number of homes in Texas; (2) demonstrate its effectiveness in reducing conventional non-renewable energy resources; (3) educational in the use of readily available materials that can be integrated with existing homes to construct simple inexpensive solar systems; and (4) training of anyone with average carpentry skills. With the exception of goal 2, all goal objectives have been achieved (see project development below). Next heating season will be needed to evaluate the system effectiveness.

7410 **(DOE/R6/12059—T1) Low cost passive solar adobe house.** (Caldwell (Phillip Mack), El Paso, TX (USA)). 21 Dec 1981. Contract FG46-80R612059. 7p. NTIS, PC A02/MF A01. Order Number DE84003506.

A brief description, photographs, and cost breakdown of a hybrid direct-gain passive solar adobe house constructed in the City of El Paso, Texas. The 3-panel active solar domestic hot water system acts as a back-up to the direct gain passive system.

7411 **(DOE/R6/12066—T1) Solar powered wastewater treatment plant. Final report.** Venhuizen, D. (San Marcos, City of, TX (USA)). 6 Nov 1981. Contract FG46-80R612066. 155p. NTIS, PC A08/MF A01. Order Number DE84003229.

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Enhancement of the ability of a hyacinth pond to provide secondary effluent was studied. Control of flow geometry was addressed, and the hyacinth pond's role as part of an overall treatment system was emphasized. The use of greenhouses over the ponds to protect the plants during the winter was evaluated. The thermal and structural performances of the greenhouses were analyzed. It was concluded that the plants could be kept alive and green with only a tarpaulin-like cover in the winter climate of Texas, but to keep the plants actively growing would require a tightly built greenhouse with good infiltration control. The third area of investigation was the potential of wind power for providing energy for wastewater aeration. Aeration methods amenable to the use of wind power as the prime mover were investigated and found to compare favorably with standard aeration methods. The wind distribution at the site was monitored to determine whether the wind could be relied upon as a source of aeration energy.

7412 **(DOE/R6/12322—T2) Solar Kiln Handbook and Workshops. Final report.** Robbins, A.M. (New Mexico Univ., Albuquerque (USA). New Mexico Energy Research and Development Inst.). 31 Jun 1982. Contract FG46-81R612322. 44p. NTIS, PC A03/MF A01. Order Number DE84003427.

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The DOE Appropriate Technology Small Grants Program project entitled Solar Kiln Handbook and Workshops completed three Solar Lumber Kiln workshops and published a text called Solar Lumber Kilns - Design Ideas. In addition, much information was complied and shared in conversations with those that operate solar kilns. The project is deemed a success, by the principal investigator, in that attendance goals were met at each of the workshops and many requests for the publication have been received. Audience participation, interest and enthusiasm was very high. Many compliments have been received concerning the text along with individual requests for obtaining copies. A total of 2250 copies were printed and successfully distributed to the Region VI's five state energy offices county extension services, forestry centers and other energy related agencies. A copy of this text is attached to this report.

7413 **(DOE/R6/12325—T1) Solar domestic hot water systems. Final report.** (Alamo Navajo School Board, Inc., Magdalena, NM (USA)). [nd]. Contract FG46-81R612325. 6p. NTIS, PC A02/MF A01. Order Number DE84003428.

This report deals with the application of an appropriate technology, namely, solar domestic hot water heaters in a very specialized milieu within the larger society. In bringing solar domestic hot water to the Alamo Navajo Reservation this unique project was involved in the socialization of an appropriate technology. During the period of the project, the people of the Reservation became acquainted with principles of solar heat as used in the domestic hot water units, and learned to construct and install these units into various plumbing conditions. The project has demonstrated that a technology can be brought into a nontechnical community provided the community has a sense of trust in the local representative and the activity is locally based so that recourse on either the manufactured product or the maintenance service will be available. The experience of this project suggests several areas for continued inquiry.

7414 **(DOE/SF/11681—T1) Passive-solar-cooling system concepts for small office buildings. Final report.** Whiddon, W.I.; Hart, G.K. (Whiddon (W.I.) and Associates, Inc., Bethesda, MD (USA); Hart, McMurphy and Parks, Bethesda, MD (USA)). Feb 1983. Contract AC03-82SF11681. 116p. NTIS MF A01. Order Number DE83017461.

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This report summarizes the efforts of a small group of building design professionals and energy analysis experts to develop passive solar cooling concepts including first cost estimates for small office buildings. Two design teams were brought together at each of two workshops held in the fall of 1982. Each team included an architect, mechanical engineer, structural engineer, and energy analysis expert. This report presents the passive cooling system concepts resulting from the workshops. It summarizes the design problems, solutions and first-cost estimates relating to each technology considered, and documents the research needs identified by the participants in attempting to implement the various technologies in an actual building design. Each design problem presented at the workshops was based on the reference (base case) small office building analyzed as part of LBL's Cooling Assessment. Chapter II summarizes the thermal performance, physical specifications and estimated first-costs of the base case design developed for this work. Chapters III - VI describe the passive cooling system concepts developed for each technology: beam daylighting; mass with night ventilation; evaporative cooling; and integrated passive cooling systems. The final Chapters, VII and VIII present the preliminary implications for economics of passive cooling technologies (based on review of the design concepts) and recommendations of workshop participants for future research in passive cooling for commercial buildings. Appendices provide backup information on each chapter as indicated.

7415 **(DTH-LV—123) Solar systems for domestic hot water. The development of an efficient solar system for domestic hot water.** Ellehauge, K. (Danmarks Tekniske Hoejskole, Lyngby. Lab. for Varmeisolering). Nov 1982. 47p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84750083.

Systematic work has been carried out to analyse the function of domestic hot water solar systems for single-family dwellings. In collaboration with manufacturers of solar components a solar system has been developed. This system has been mounted at the laboratory and measurements have been performed for a year. The system has had a yearly performance of 380 kWh/year m^2 collector and this gives a system efficiency of 38% over a year. The fraction of solar used for domestic hot water has been 66% over the year while the fraction of solar for six summer months has been about 90%. These figures show a distinct improvement compared to measuements which have earlier been reported in Denmark and throughout Europe. The measurements have been used to validate a computer model and with this model a lot of parametric variations have been performed to analyse the system. The experiment has been followed by three other experiments.

7416 **(NP—3770171) Briefing package: Solar architecture and energy-minded construction.** Hemmers, R. (Fachinformationszentrum Energie, Physik, Mathematik G.m.b.H., Bonn (Germany, F.R.). Buero Bonn). Sep 1982. 168p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE83770171.

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The present information package depicts the principles of solar architecture to encourage the inclusion of these elements in the planning of private buildings. It is shown that energy conservation should be planned when constructing the building.

7417 **(SERI/SP—281-1692) Survey of European passive solar buildings.** Robert, J.F.; Camous, R.; Schneider, F. (Centre National de la Recherche Scientifique, 66 - Font-Romeu (France). Lab. d'Energetique Solaire). Dec 1982. Contract AC02-77CH00178. 225p. NTIS, PC A10/MF A01. Order Number DE84003024.

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This survey of European passive solar buildings covers buildings in Andorra, Belgium, France, Ireland, Italy, Spain, Sweden, Switzerland, Turkey, and the United Kingdom. Along with a photograph, the following information is given in most cases: location; identification; climate; design concept; construction; plan; and solar system.

7418 **(SOLAR/0024—83/41) Comparative report: performance of solar-hot-water systems, 1981-1982.** Raymond, M.G. (Vitro Labs., Silver Spring, MD (USA)). 1983. Contract AC01-79CS30027. 166p. NTIS, PC A08/MF A01. Order Number DE84001750.

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The performance of solar water heating systems at 13 sites across the United States is compared. Areas of comparison include collection subsystem performance and hot water subsystem performance. Specific trends and generalizations are also summarized. For each site there is a brief system description and energy flow diagram. (LEW)

7419 **(SOLAR/0025—83/42) Comparative report: performance of active solar space heating systems, 1981-1982 heating season.** Kendall, P.W.; Pollock, E.O.; Spears, J.W. (Vitro Labs., Silver Spring, MD (USA)). [nd]. Contract AC01-79CS30027. 197p. NTIS, PC A09/MF A01. Order Number DE84003205.

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This report is the third in a series of reports which present composite performance results for active solar space heating systems in the National Solar Data Network (NSDN). Sections of this report have been organized to permit the reader to examine areas of special interest as well as to highlight general results. Section II presents an overview of the systems evaluated in this report, including a summary of the individual system parameters. Section III contains comparisons of seasonal performance data for the 16 systems. In addition, analysis results are presented in graphic form to highlight key summary information. Section IV provides a summary of comparative results for systems monitored during the 1981-1982 space heating season with conclusions which may be drawn from the data. This section also summarizes the mechanical problems which reduced system performance. Section V provides a list of reference material used. Specific detailed data and information necessary to support the development of results presented are contained in the appendices to this report. For the 16 systems included in this report, some of the general conclusions, supported by the data, are the following: no one type of system or subsystem was superior; good system performance was more dependent on proper selection and sizing of the system components than on the type of system; and the most common cause of poor system performance was controller failure or malfunction.

7420 **(SOLAR/2125—83/14) Solar-energy-system performance-evaluation update: Wood Road School, Ballston Spa, New York, October 1982-April 1983.** Kendall, P. (Vitro Labs., Silver Spring, MD (USA)). 1983. Contract AC01-79CS30027. 60p. NTIS, PC A04/MF A01. Order Number DE84000430.

The Wood Road School Solar Project is a 216,000 square foot combined elementary and middle school in Ballston Spa, New York. The solar energy system supplies energy to the space heating and domestic hot water subsystems. Heat is collected by flat plate collector panels and stored in two storage tanks. Performance data are given for the system overall and for each of the four subsystems - energy collection, storage, space heating, and domestic hot water. Data are also provided on operating energy, energy savings, and weather conditions. Design and actual system solar fraction are compared, and percentage of incident solar energy and collected solar energy utilized are given. Also given are building loads analysis, system thermal losses, and system coefficient of performance. (LEW)

7421 **(TENRAC/EDF—086) Conceptual study of a salt gradient solar pond in the crude oil production industry. Final report.** Manning, R.A.; Wisneski, T.P.; Clark, E.E. (Applied Solar Engineering, Inc., San Antonio, TX (USA)). 26 Jan 1983. 81p. NTIS, PC A05/MF A01. Order Number DE84900406.

This project is a conceptual study of the application of Salt Gradient and Solar Pond (SGSP) technology to the crude oil production operation of the Double U Oil Company near Big Wells, Dimmit County, Texas. The SGSP is intended to provide 140°F process heat to an emulsion of crude oil and brine that comes from several producing wells, in order to assist in the separation of the oil from the waste brine. A preliminary design of the facility has been prepared, including the sizing of the SGSP and all major equipment. Pond development processes have been established that use the waste brine from crude oil production as a low-cost source of salt water for the SGSP itself. An economic analysis has been conducted that includes the effects of capital/operating costs, energy and tax savings, and reduction or elimination of waste brine disposal fees currently paid by the crude oil producer. For the Big Wells application, i.e., production rates of 150 barrels per day (BPD) of crude oil plus 65 BPD of brine, a pond area of 16,500 square feet is appropriate. Overall pond depth is 11 1/2 feet and the storage layer depth if 6 1/2 feet. The initial capital cost of the SGSP facility is estimated to be about $91,000. Based on a 20-year system life, a current wellhead price of natural gas of $2.13 per thousand cubic feet, and brine disposal charges of $0.92 per barrel, the total net savings should exceed $339,000 in 1982 dollars. Approximately 75 million cubic feet of natural gas usage should be displaced during the life of the facility. The use of a solar pond in this application appears to be technically feasible and economically attractive. It is recommended that the Big Wells solar pond facility be designed in detail and then constructed.

7422 **(TENRAC/EDF—088) Development of jet pump solar cooling system. Final report.** Holmes, R.E.; Zeren, F. (Texas A and M Univ., College Station (USA). Dept. of Mechanical Engineering). 5 May 1983. 136p. NTIS, PC A07/MF A01. Order Number DE84900419.

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A small vapor jet solar cooling system capable of cooling about one room (7000 Btu/h) was designed, built and performance tested. The vapor jet solar cooling system is a new low cost cooling system which runs primarily on solar energy from relatively low cost flat plate solar collectors. The jet pump solar cooling system is basically a standard vapor compression cooling system, except the compressor in the standard system is replaced by a solar driven jet pump. This project includes six parts: (1) develop a computer model for a vapor jet solar cooling system; (2) use the computer model to predict system performance and cost; (3) use the computer results to design an experimental system; (4) perform an economic analysis of the system, and estimate purchase and operating costs compared with other systems; (5) build a small vapor jet solar cooling system; and (6) do limited system performance testing. The results have been completed including performance testing using heat supplied by a gas fired hot water heater. While the

system has not yet operated in a solar energy mode, the principle of its operation has been clearly demonstrated. The system gave the most efficient operation at simulated collector temperatures of 140 to 160°F. Presently plans are proceeding to operate the system using solar collectors. This test should demonstrate even more clearly the tremendous potential for this new cooling system.

7423 **Performance of naturally ventilated homes.** Chandra, S.; Keresteciogiu, A.; Cromer, W. (Florida Solar Energy Center, Cape Canaveral, FL). pp 807-812 of Progress in passive solar energy systems. Hayes, J.; Winn, C.B. (eds.). New York, NY; American Solar Energy Society (1982). (CONF-820819—).

From 7. national passive solar conference; Knoxville, TN, USA (30 Aug 1982).

Natural or fan-forced ventilation/air motion can significantly reduce the summertime cooling costs of buildings. The authors are conducting research to quantitatively understand the physics of ventilaton so as to prepare a ventilation design handbook. This paper summarizes the research program and presents data for two ventilated homes and one room of the FSEC-Passive Cooling Laboratory (PCL). The data consist of air and surface temperatures, internal air speeds and airchange rates.

7424 **A rotating-prism, movable-mass, solar energy system.** Rost, D.F.; Ameduri, G. (Solar Energy Engineering, Poland, OH). pp 843-848 of Progress in passive solar energy systems. Hayes, J.; Winn, C.B. (eds.). New York, NY; American Solar Energy Society (1982). (CONF-820819—).

From 7. national passive solar conference; Knoxville, TN, USA (30 Aug 1982).

The rotating-prism, movable-mass, solar energy system consists of rectangular, regular prisms containing water and phase change material rods. One large face is an absorptive/radiative surface and the other is insulated. The concept is to face the absorptive surface toward the sun to collect energy which is then stored directly in the mass, then turn the prism around to deliver the energy into the space with the insulated side out to reduce thermal losses. This forms a system which can be visualized as a segmented Trombe wall that can be controlled by placing insulation on the desired side (glazing cavity or room side) to maximize its performance.

7425 **Study of a radiative and evaporative roof cooling technique for large cool storage buildings.** Boghosian, S.H. (East Palo Alto, CA). pp 893-998 of Progress in passive solar energy systems. Hayes, J.; Winn, C.B. (eds.). New York, NY; American Solar Energy Society (1982). (CONF-820819—). Contract FG03-80R950041.

From 7. national passive solar conference; Knoxville, TN, USA (30 Aug 1982).

A modeling, design, and economics study for a radiative cooling scheme applied to a 13°C cool storage warehouse is reported in this paper. The radiative cooling scheme involves nocturnal circulation of building air through a roof system air passage located between the outer metal skin and the roof insulation. Air is drawn from the room, cooled by the radiating roof skin, then blown back into the room to remove heat from the massive building contents. Building modeling results from the TRNSYS simulation program (using Fresno, California weather data) are shown, and results from a life-cycle costing technique are used to indicate cooling energy savings rate of return on capital expenditure for the roof cooling system. The cooling system is shown to be uneconomical for the particular situation modeled. However, approximate calculations are used to indicate that realistic modifications to the building should result in desirable rates of return.

7426 **A simple verified methodology for thermal design of roof pond cooled buildings.** Fleischhacker, P.; Bentley, D.; Clark, G. (Trinity Univ., San Antonio, TX). pp 899-904 of Progress in passive solar energy systems. Hayes, J.; Winn, C.B. (eds.). New York, NY; American Solar Energy Society (1982). (CONF-820819—). Contract AC03-79CS30201.

From 7. national passive solar conference; Knoxville, TN, USA (30 Aug 1982).

A simple verified thermal design methodology for roof pond cooled buildings is presented. Based upon a simplified load estimation procedure and simple sizing equations, roof pond areas and depths required to maintain desired indoor temperatures may be determined for wet or dry roof pond structures anywhere in the U.S. Adjustment factors for pond depth, increased nighttime internal loads and exposed pond area allow application of the results to any particular building design. The design methodology provides thermal information required for evaluation of economic trade offs. Effects of decreased infiltration, decreased envelope load, pond characteristics, ceiling fans and auxiliary air conditioning on peak temperature can be evaluated.

7427 **Models and measurements of radiative cooling.** Blampied, M.; Cummings, J.B.; Clark, G.; Schutt, B. (Trinity Univ., San Antonio, TX). pp 905-910 of Progress in passive solar energy systems. Hayes, J.; Winn, C.B. (eds.). New York, NY; American Solar Energy Society (1982). (CONF-820819—). Contract FG05-77ET20152;AC03-79CS30201.

From 7. national passive solar conference; Knoxville, TN, USA (30 Aug 1982).

Two recent models for estimation of nocturnal irradiance under clear and cloudy skies are compared with measurements made during six months in San Antonio, Texas. For clear humid summer conditions, the mean error in both models is less than the estimated 3% measurement uncertainty. The Berdahl and Fromberg clear sky model used with the Berdahl and Martin cloud correction resulted in the most accurate estimates. The sensitivity of the peak interior temperature of a roof pond cooled residence to errors in estimated nocturnal irradiance is simulated using validated algorithms. A change of +/-5% in sky emittance changes the peak interior temperature by +/-3°C for a residence with a sealed roof pond and by 0.8°C with an open pond.

7428 **Dehumidification and passive cooling for retrofit and conventional construction.** Haves, F.; Loxsom, F.; Doderer, E.S. (Trinity Univ., San Antonio, TX). pp 911-916 of Progress in passive solar energy systems. Hayes, J.; Winn, C.B. (eds.). New York, NY; American Solar Energy Society (1982). (CONF-820819—).

From 7. national passive solar conference; Knoxville, TN, USA (30 Aug 1982).

Passive/hybrid cooling and dehumidification systems suitable for conventional construction and retrofit in the hotter and more humid climates of the U.S. are described. Sensible cooling may be provided using the "trickle roof" roof dissipator system or an indirect evaporative cooler. Dehumidification may be achieved with an improved vapor compression dehumidifier or a solar regenerated desiccant dehumidifier. Advantages and disadvantages of each system and their combinations are discussed. Winter heating capability is also discussed.

7429 **Passive and hybrid ice systems for comfort conditioning and chilling applications.** Francis, C.E. (Illinois State Univ., Normal); Gorski, A.J. pp 923-926 of Progress in passive solar energy systems. Hayes, J.; Winn, C.B. (eds.). New York, NY; American Solar Energy Society (1982). (CONF-820819—).

From 7. national passive solar conference; Knoxville, TN, USA (30 Aug 1982).

The idea of using winter's cold weather to make naturally frozen ice for subsequent use during the following summer is currently being investigated by several researchers across the North American Continent. There are as many different systems as there are researchers; each system has its own characteristics, advantages, and disadvantages. Additionally, these systems range from passive and hybrid to active type systems operation. This paper presents some general information about ice applications, advantages of naturally frozen ice, performance data and descriptions of the several known systems.

7430 **Passively cooled cold storage for agricultural products and a direct method of measuring nocturnal cooling potential.** Schlussler, L. (Sun Frost, Orcata, CA). pp 927-932 of Progress in passive solar energy systems. Hayes, J.; Winn, C.B. (eds.). New York, NY; American Solar Energy Society (1982). (CONF-820819—).

From 7. national passive solar conference; Knoxville, TN, USA (30 Aug 1982).

A passively cooled cold storage area for agricultural products has been constructed and tested. It is located in Willow Creek, a town in north central California. The storage area maintains a temperature of 55 F (13°C) in use, when summer temperatures typically reach a high of 93 F (34°C) and a low of 53 F (11.5°C). The 8 foot (2.45 m) by 8 foot underground storage room is cooled by a ground level 11-foot (3.35 m) square roof pond. During the course of this project a technique was developed to directly measure the radiative and evaporative cooling capacity. The technique is of value because it alleviates the need for the considerable amount of microclimatic data needed for the calculation of evaporative, convective and radiative cooling capacities. This method is also often more accurate than the analytic approach.

7431 **Performance of a thermosiphon wall heating system.** Morris, W.S. (Morris Research & Design, Sante Fe, NM). pp 951-956 of Progress in passive solar energy systems. Hayes, J.; Winn, C.B. (eds.). New York, NY; American Solar Energy Society (1982). (CONF-820819—).

From 7. national passive solar conference; Knoxville, TN, USA (30 Aug 1982).

This report describes the performance of a 2,000 sq. ft. house in Santa Fe, New Mexico, which utilizes a unique thermosiphon air collector system to heat four vertical wall-type rock beds, which then provide radiant heat to the interior. Construction was completed, and the house occupied, in March, 1980. Intensive monitoring during January and February, 1981, provided an extensive data base on thermal performance. Despite several apparent problems, the overall performance was very good (SSF = 90%+).

7432 **Design procedures for thermosiphon air collectors.** Morris, W.S. (Morris Research & Design, Santa Fe, NM). pp 969-974 of Progress in passive solar energy systems. Hayes, J.; Winn, C.B. (eds.). New York, NY; American Solar Energy Society (1982). (CONF-820819—).

From 7. national passive solar conference; Knoxville, TN, USA (30 Aug 1982).

This report presents a reasonably simple method of designing thermosiphon air collectors, and estimating their performance based on empirical data. The techniques are quite simple, but do require that the designer have access to, and knowledge of, the standard methods of determining presure loss in ductwork.

7433 **Passive solar heating of buildings in the Andes.** Pierson, H.O. (Sandia National Lab., Albuquerque, NM). pp 507-509 of Progress in passive solar energy systems. Hayes, J.; Winn, C.B. (eds.). New York, NY; American Solar Energy Society (1982). (CONF-820819—). Contract AC04-76DP00789.

From 7. national passive solar conference; Knoxville, TN, USA (30 Aug 1982).

This report is a system analysis of the potential of passive solar heating of buildings in the high Andean basins of South America at altitudes up to 4800 m. This region has low average temperature (9 to 12°C in Huancayo), a large diurnal temperature excursion (up to 20°C) and a consistently high insolation (> 20 MJ/m^2 per day). It is well suited for the development of passive solar heating of buildings. The zenith angle of the sun is low due to the proximity of the equator. This factor dictates the inclination of the collector which for maximum efficiency should be at an angle equal to the latitude and facing north. Thus roof colletors should be preferred over vertical walls such as Trombe walls. This may take the form of water-filled tubular structures or transparent roofs for direct gain within the building or an attached greenhouse or any combination of these.

7434 **Evaluation of the Los Alamos Scientific Laboratory's residential passive solar methods applied to small commercial buildings.** Arnoth, D.E. (Univ. of New Mexico, Albuquerque). pp 133-135 of 4th Miami international conference on alternative energy sources. Veziroglu, T.N. (ed.). Coral Gables, FL; Univ. of Miami (1982). (CONF-811212—).

From 4. international conference on alternative energy sources; Miami Beach, FL, USA (14 Dec 1981).

1410 Solar Collectors And Concentrators

7435 **(DOE/R6/10996—T2) Effect of dynamic flow rates on the efficiency of flat-plate solar collectors.** Petrosky, G.E. Jr. (Southeastern Louisiana Univ., Hammond (USA)). 1978. Contract FG46-79R610996. 76p. NTIS, PC A05/MF A01. Order Number DE84003138.

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The effect of a dynamic flow rate on the efficiency of a flat-plate solar collector is investigated by comparing the efficiency of the collector with the optimum constant flow rate to that of the efficiency of the collector with a dynamic flow rate. Measurements on the two systems under outdoor conditions are reported.

7436 **(DOE/R6/12050—T1) Salt gradient solar pond. Final report, October 1982-February 1983.** Whiteside, C.H. (Ana-Lab Corp., Kilgore, TX (USA)). 8 Mar 1983. Contract FG46-80R612050. 12p. NTIS, PC A02/MF A01. Order Number DE84003126.

The project reported proposed to construct a 40 x 50 foot solar pond with a plastic liner and a heat exchanger. The project is described both as it was proposed and as built. Problems encountered are described, including impurities in the brine and keeping the project on schedule. (LEW)

7437 **(DOE/R6/12064—T1) Low cost concentrating collector. Final report.** Ochs, G. (Ochs (Greg), Austin, TX (USA)). 22 Jul 1982. Contract FG46-80R612064. 15p. NTIS, PC A02/MF A01. Order Number DE84003123.

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This report is a record of the research conducted for the development of a low cost, modularized, concentrating collector. The basic concept of the project was to develop a concentrating solar collector using readily available materials and simple construction techniques. The final product was to be an easily assembled, low cost collector of moderate efficiency. The collector was being designed for industrial markets requiring high temperatures above the typical operating range of flat plates. After experimenting with several different design concepts, a final design was established. The basic collector consisted of a parabolic trough reflector covered by an inverted parabolic acrylic cover. The operation, prototype construction, test results, and construction cost estimates are presented. Also included are a financial statement, a summary, and photographs.

7438 **(DTH-LV-MEDD—133) Reliability and durability of solar collectors. Evaluation of 22 solar collectors based on tests.** Vejsig Pedersen, P.; Mikkelsen, S.E. (Danmarks Tekniske Hoejskole, Lyngby. Lab. for Varmeisolering). Jul 1983. 99p. (In Danish). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84750084.

Twenty-two solar collectors have been tested on the laboratory's equipment for indoor test of the reliability and durability of solar collectors. The collectors represent the Danish market in 1980. The following tests have been made: air leakage, stagnation test, temperature shock of absorber and cover, thermal cycling, rain-leakage with and without simulated wind load on cover. The result showed that the indoor test was useable, and especially the stagnation test and the rain-leakage test gave good information on the reliability and durability of solar collectors. The most serious problems were outgassing on the cover from plast-foam (polyurethane) and rain-leakage. The outgassing results in a lower transmission and after some time in a degradation of the insulation material. For some collectors the outgassing became so severe that the absorberplate could not be seen. This happens when dust after some time

is combined with the outgassing. The tested collectors belong to the 1st generation of collectors and the test pointed out some serious problems. On the other hand the test also proved that some collectors are satisfactory.

7439 **(LBL—16748) Small Particle Heat Exchange Receiver - solar test results.** Hunt, A.J. (Lawrence Berkeley Lab., CA (USA)). Sep 1983. Contract AC03-76SF00098. 8p. (CONF-830990—4). NTIS, PC A02/MF A01. Order Number DE84003043.

From Solar thermal research workshop; Atlanta, GA, USA (7 Sep 1983).

The Small Particle Heat Exchange Receiver operates by injecting a very small mass of absorbing particles into the working gas. The gas-particle mixture passes into the solar receiver that consists of a hollow chamber with a window. Concentrated sunlight enters through the window and passes into the gas-particle suspension. The particles absorb the sunlight, rapidly transferring the heat to the surrounding gas. The particles may react with the gas to form a clear exhaust. The receiver tested utilized carbon particles in air. The carbon oxidizes after heat exchange. The receiver was tested at the Advanced Component Test Facility (ACTF) where it was mounted on a tower to receiver solar flux up to 200 W/cm^2 Receiver operation was monitored with thermocouples, pressure transducers, and laser probes that measured the absorption of light by the particle suspension. Major test objectives that were met include oxidation of the particles, proof that concentrated sunlight can be absorbed directly within a working gas by small particle, and proof that a window can be used successfully in a high-temperature environment and that carbon build-up on the window was not a problem. (LEW)

7440 **Solar collector apparatus having increased energy rejection during stagnation.** Moore, S.W. (to Dept. of Energy). US Patent 4,392,481. 12 Jul 1983. Filed date 16 Jan 1981. vp.

PAT-APPL-225493.

The disclosure relates to an active solar collector having increased energy rejection during stagnation. The collector's glazing is brought into substantial contact with absorber during stagnation to increase re-emittance and thereby to maintain lower temperatures when the collector is not in operation.

1420 Heat Storage

REFER ALSO TO CITATION(S) 7389

15 GEOTHERMAL ENERGY

1501 Resource Status And Assessment

7441 **(DOE/ID/01717—4) State-coupled low temperature geothermal resource assessment program, Fiscal Year 1982. Final technical report.** Icerman, L.; Starkey, A. (eds.). (New Mexico State Univ., Las Cruces (USA). New Mexico Energy Inst.). Sep 1983. Contract AS07-78ID01717. 294p. NTIS, PC A13/MF A01. Order Number DE84002640.

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Separate abstracts were prepared for twelve papers. (MHR)

7442 (DOE/ID/01717—4, pp 1.1-1.11) **Scientific geothermal resources map series for New Mexico.** Swanberg, C.A. (New Mexico State Univ., Las Cruces). Sep 1983. NTIS, PC A13/MF A01.

In State-coupled low temperature geothermal resource assessment program, Fiscal Year 1982. Final technical report.

The purpose of this task was to compile all geothermally related scientific data for the state of New Mexico and present these data in a series of maps designed for use by the scientific community to be published by the National Geophysical and Solar-Terrestrial Data Center of the National Oceanic and Atmospheric Administration (NOAA) in 1983. All appropriate data have been collected and forwarded to NOAA for the preparation of the final map series. The status of each map in two series is presented. 86 references.

7443 (DOE/ID/01717—4, pp 5.1-5.11) **Summary of the low temperature geothermal resource assessment program in New Mexico.** Icerman, L. (New Mexico State Univ. Energy Inst., Las Cruces). Sep 1983. NTIS, PC A13/MF A01.

In State-coupled low temperature geothermal resource assessment program, Fiscal Year 1982. Final technical report.

The four-year research effort on low-temperature geothermal resource exploration and assessment is discussed briefly. This broadly based research has revealed numerous areas in New Mexico that may contain commercially exploitable low-temperature geothermal resources. An important component of this program has been basic studies in specific regions of New Mexico, including areas adjacent to the cities of Albuquerque, Las Cruces, Socorro, and Truth or Consequences. Considerable geological, hydrological, electrical resistivity, gravity, magnetic, seismic, water analysis, and subsurface temperature data have been compiled and analyzed by university researchers for these locations.

1502 Geology And Hydrology Of Geothermal Systems

REFER ALSO TO CITATION(S) 7456

7444 **(DOE/ET/27111—T2) Continuity and internal properties of Gulf Coast sandstones and their implications for geopressured fluid production.** Morton, R.A.; Ewing, T.E.; Tyler, N. (Texas Univ., Austin (USA). Bureau of Economic Geology). 1983. Contract AC08-79ET27111. 75p. NTIS, PC A04/MF A01. Order Number DE84004396.

The intrinsic properties of the genetic sandstone units that typify many geopressured geothermal aquifers and hydrocarbon reservoirs in the Gulf Coast region were systematically investigated classified, and differentiated. The following topics are coverd: structural and stratigraphic limits of sandstone reservoirs, characteristics and dimensions of Gulf Coast sandstones; fault-compartment areas; comparison of production and geologic estimates of aquifer fluid volume; geologic setting and reservoir characteristics, Wells of Opportunity; internal properties of sandstones; and implications for geopressured fluid production. (MHR)

7445 (DOE/ID/01717—4, pp 3.164-3.182) **Regional geothermal exploration in north central New Mexico. Part 5. Geothermal resources of the Rio Grande Rift.** Swanberg, C.A. (New Mexico State Univ., Las Cruces). Sep 1983. NTIS, PC A13/MF A01.

In State-coupled low temperature geothermal resource assessment program, Fiscal Year 1982. Final technical report.

The geologic setting and constriction-related geothermal resources of the Rio Grande Rift and geothermal resources of Volles Caldera are described. Temperature gradients and geothermal gradients for geothermal wells in the Valles Caldera are shown. (MHR)

1503 Geothermal Exploration And Exploration Technology

REFER ALSO TO CITATION(S) 7441, 7445

7446 (DOE/ID/01717—4, pp 2.1-2.38) **Regional geothermal assessment in the Otero County area.** Lohse, R.L. (New Mexico State Univ. Energy Inst., Las Cruces). Sep 1983. NTIS, PC A13/MF A01.

In State-coupled low temperature geothermal resource assessment program, Fiscal Year 1982. Final technical report.

The geologic setting is described. The following data are presented and discussed: actual temperature, bottom-hole temperature gradient, geothermometry, anomalous temperature, anomalous geothermometry, tectonic features, lineament and gravity. (MHR)

7447 (DOE/ID/01717—4, pp 3.1-3.43) **Regional geothermal exploration in north central New Mexico. Part 1. Analysis of the geothermal energy potential of north central New Mexico.** Lohse, R.L. (New Mexico State Univ. Energy Inst., Las Cruces). Sep 1983. NTIS, PC A13/MF A01.

In State-coupled low temperature geothermal resource assessment program, Fiscal Year 1982. Final technical report.

An analysis of temperature and geotemperature data from numerous sites throughout north central New Mexico results in several important observations. Actual temperature and bottomhole temperature gradient data both suggest that two separate thermal regimes characterize the background temperatures in the upper crust within the study area. This result is suggested by the fact that there is almost a total absence of actual temperatures less than 15°C within the crust in the southwest portion of the study area. Superimposed upon these regional background temperatures are a very large thermal anomaly, located throughout the center of the study area containing both high- and low-temperature resources, and several isolated low-temperature resource areas located in the northeast portion of the study area.

7448 (DOE/ID/01717—4, pp 3.44-3.112) **Regional geothermal exploration in north central New Mexico. Part 2. Measured geothermal gradients in north central New Mexico.** Hunter, J.C. (Los Alamos National Lab., NM). Sep 1983. NTIS, PC A13/MF A01.

In State-coupled low temperature geothermal resource assessment program, Fiscal Year 1982. Final technical report.

This study was initiated to collect and integrate data on geothermal gradients in north central New Mexico and to identify areas with characteristics favorable for the development of low-temperature geothermal resources. Temperature gradients were measured in 22 water wells and potentially favorable areas for geothermal resource development were identified at Santa Ana Pueblo, Ojo Caliente, La Cueva, and Taos.

7449 (DOE/ID/01717—4, pp 3.113-3.147) **Regional geothermal exploration in north central New Mexico. Part 3. Temperature gradient studies near two groundwater constrictions in northern New Mexico.** Swanberg, C.A. (New Mexico State Univ., Las Cruces). Sep 1983. NTIS, PC A13/MF A01.

In State-coupled low temperature geothermal resource assessment program, Fiscal Year 1982. Final technical report.

The Embudo and La Bajada constrictions are two groundwater constrictions located in north central New Mexico. Groundwater constriction theory suggests that both should be associated with geothermal resources yet no geothermal discoveries have been made, quite likely due to the lack of data and/or the lack of a suitable geothermal investigation. The purpose of the present investigation was to locate and thermally log all available wells near these two constrictions and to supplement these data with temperature-depth data (taken from oil, gas, and water wells), geochemical data, and any other appropriate data in order to make a geothermal evaluation of the two groundwater constrictions.

7450 (DOE/ID/01717—4, pp 3.148-3.163) **Regional geothermal exploration in north central New Mexico. Part 4. Thermal data for springs and wells.** Swanberg, C.A. (comp.). (New Mexico State Univ., Las Cruces). Sep 1983. NTIS, PC A13/MF A01.

In State-coupled low temperature geothermal resource assessment program, Fiscal Year 1982. Final technical report.

Thermal and dissolved silica content data for springs and shallow groundwater wells are presented. The data have been compiled from the USGS water quality file (WATSTORE) but have not been field checked and may contain errors. Field measurements obtained as part of this study are included.

7451 (DOE/ID/01717—4, pp 3.183-3.187) **Regional geothermal exploration in north central New Mexico. Part 6. Geochemical data representing thermal and nonthermal waters from the Valles Caldera.** Swanberg, C.A. (New Mexico State Univ., Las Cruces). Sep 1983. NTIS, PC A13/MF A01.

In State-coupled low temperature geothermal resource assessment program, Fiscal Year 1982. Final technical report.

A detailed study is presented of the geochemistry from the Valles Caldera area, which is the only known high-temperature (e.g., > 150°C) geothermal resource area in New Mexico. The geochemical data were compiled from Goff et al. (1981), Goff et al. (1982), and Summers (1976) and are reported as follows: isotope and chemical geothermometry data for the Valles Caldera, and groundwater chemistry for the Valles Caldera. Actual temperatures, Na-K-Ca and SiO_2 (quartz) geotemperatures, and oxygen and deuterium isotope data for 55 sites are summarized. Simplified geology of the Valles Caldera and groundwater chemistry for the 55 sites are shown. The water chemistry data are shown in the form of stiff (chemical) diagrams.

7452 (DOE/ID/01717—4, pp 3.188-3-206) **Regional geothermal exploration in north central New Mexico. Part 7. Evaluation of the Na-K, Na-Li, K-Li, SiO_2 (quartz), SiO_2 (chalcedony), and Na-K-Ca geothermometers.** Swanberg, C.A. (New Mexico State Univ., Las Cruces). Sep 1983. NTIS, PC A13/MF A01.

In State-coupled low temperature geothermal resource assessment program, Fiscal Year 1982. Final technical report.

Three new geothermometers, namely, Na-K, K-Li, and Na-Li (Kharaka, 1981) were tested on thermal and nonthermal waters in New Mexico by computing correlations with the widely-accepted SiO_2 (quartz), SiO_2 (chalcedony), and Na-K-Ca geothermometers. Subsurface temperature estimates based on the new geothermometers were planned for use in the geothermal resources of New Mexico scientific map series (Swanberg, 1983) if the correlations warranted use of these new geochemical exploration tools.

7453 (DOE/ID/01717—4, pp 4.1-4.14) **Aeromagnetic and Bouguer gravity maps of New Mexico. Part 1. Composite residual total intensity aeromagnetic map.** Cordell, L. Sep 1983. NTIS, PC A13/MF A01.

In State-coupled low temperature geothermal resource assessment program, Fiscal Year 1982. Final technical report.

Background and data sets are described for the composite map. The techniques used to analyze the data and join surveys are discussed. (MHR)

7454 (DOE/ID/01717—4, pp 4.15-4.18) **Aeromagnetic and Bouguer gravity maps of New Mexico. Part 2. Bouguer gravity map of New Mexico.** Keller, G.R. (Univ. of Texas, El Paso); Cordell, L. Sep 1983. NTIS, PC A13/MF A01.

In State-coupled low temperature geothermal resource assessment program, Fiscal Year 1982. Final technical report.

The complete Bouguer gravity map of New Mexico is presented, which will be included as part of the scientific geothermal resources map of New Mexico (Swanberg, 1983). Figures are complete Bouguer gravity maps of New Mexico originally drafted at a scale of 1:500,000.

7455 (USGS/MAP/MF—1379-B) **Map showing geothermal investigations in the vicinity of the Mount Hood Wilderness, Clackamas and Hood River Counties, Oregon.** Robinson, J.H.; Keith, T.E.C.; Beeson, M.H.; Bargar, K.E. (Geological Survey, Denver, CO (USA)). 1982. 18p. Geological Survey, Box 25286, Federal Center, Denver, CO 80225.

Includes 2 pages of text, 23 references, 1 table.

7456 (USGS-PP—1044-J) **Hydrology and geochemistry of thermal ground water in southwestern Idaho and north-central Nevada.** Young, H.W.; Lewis, R.E. (Geological Survey, Boise, ID (USA)). 1982. 42p. GPO.

Includes Geological Survey maps.

Chemical analyses of water from 12 wells and 9 springs indicate that nonthermal waters are a calcium bicarbonate type; thermal waters are a sodium carbonate or bicarbonate type. Chemical geothermometers indicate probable maximum reservoir temperatures are near 100° Celsius. Concentration of tritium in the thermal water is near zero. Depletion of stable isotopes in the hot waters relative to present-day meteoric waters indicates recharge to the system probably occurred when the climate averaged 3° to 5° Celsius colder than at present. Temperatures about 3.5° Celsius colder than at present occurred during periods of recorded Holocene glacial advances and indicate a residence time of water in the system of at least several thousand years. Residence time calculated on the basis of reservoir volume and thermal-water discharge is 3400 to 6800 years for an effective reservoir porosity of 0.05 and 0.10, re-

spectively. Preliminary analyses of carbon-14 determinations indicate an age of the hot waters of about 18,000 to 25,000 years. The proposed conceptual model for the area is one of an old system, where water has circulated for thousands, even tens of thousands, of years. Within constraints imposed by the model described, reservoir thermal energy for the geothermal system in southwestern Idaho and north-central Nevada is about 130 x 10^{18} calories.

7457 **(USGS-WSP—2194) Methods for collection and analysis of geopressured geothermal and oil field waters.** Lico, M.S.; Kharaka, Y.K.; Carothers, W.W.; Wright, V.A. (Geological Survey, Menlo Park, CA (USA)). 1982. 24p. GPO.

Present methods are described for the collection, preservation, and chemical analysis of waters produced from geopressured geothermal and petroleum wells. Detailed procedures for collection include precautions and equipment necessary to ensure that the sample is representative of the water produced. Procedures for sample preservation include filtration, acidification, dilution for silica, methyl isobutyl ketone (MIBK) extraction of aluminum, addition of potassium permanganate to preserve mercury, and precipitation of carbonate species as strontium carbonate for stable carbon isotopes and total dissolved carbonate analysis. Characteristics determined at the well site are sulfide, pH, ammonia, and conductivity. Laboratory procedures are given for the analysis of lithium, sodium, potassium, rubidium, cesium, magnesium, calcium, strontium, barium, iron, manganese, zinc, lead, aluminum, and mercury by atomic absorption and flame emission spectroscopy. Chloride is determined by silver nitrate titration and fluoride by ion-specific electrode. Bromide and iodide concentrations are determined by the hypochlorite oxidation method. Sulfate is analyzed by titration using barium chloride with thorin indicator after pretreatment with alumina. Boron and silica are determined colorimetrically by the carmine and molybdate-blue methods, respectively. Aliphatic acid anions (C_2 through C_5) are determined by gas chromatography after separation and concentration in a chloroform-butanol mixture.

1506 Environmental Aspects And Waste Disposal

7458 **(LBL—16269) Thermal effects of reinjection in geothermal reservoirs with major vertical fractures.** Pruess, K.; Bodvarsson, G.S. (Lawrence Berkeley Lab., CA (USA)). Oct 1983. Contract AC03-76SF00098. 18p. (CONF-8310121—7). NTIS, PC A02/MF A01. Order Number DE84004347.

From SPE annual technical conference; San Francisco, CA, USA (5 Oct 1983).

Possibilities for characterizing the thermal properties of fast paths by means of different types of tests (tracers, pressure transients, non-isothermal injection) are discussed. Thermal breakthrough in vertical fractures is examined in some detail, using an idealized model for which an analytical solution is available. The model shows that rapid tracer returns are not necessarily indicative of rapid thermal interference. Thermal breakthrough predictions can be made from tracer data only, if both fluid residence time and tracer dispersion are taken into account. However, due to the geometric simplifications necessary in analyzing the tracer data, thermal interference estimates on this basis appear questionable. Pressure transient tests can provide additional parameters for thermal interference predictions, but they cannot resolve the problem of non-uniqueness. A more reliable determination of thermal characteristics of fast paths appears possible from non-isothermal injection tests, combined with numerical simulation. A mixed numerical/semi-analytical approach is employed to model the three-dimensional fluid and heat flow in injection-production systems in vertical fractures, with heat transfer to and from the adjacent rock matrix. Illustrative calculations of thermal recovery after different injection periods suggest that shutting-in an injection well can prevent unacceptable temperature declines at production wells.

7459 **Implications of the Clean Air Act and other air quality regulations on geothermal development.** Glimore, C.C.; Hunsaker, D.B. (Oak Ridge National Laboratory, Oak Ridge, Tennessee). *Proceedings, Annual Meeting, Air Pollution Control Association;* 82-22.3: 16(Jun 1982).

Generation of electricity by geothermal power results in lower emissions of criteria air pollutants than power generation from fossil fuel combustion. This situation suggests that air quality regulations would not impede the development of geothermal energy resources. However, an in-depth study of the Clean Air Act and state air quality regulations has determined that such regulations have constrained geothermal development in the past, based on hydrogen sulfide (H_2S) emissions from geothermal power plants. The "federal enforceability" provision of PSD regulations has caused some geothermal plants with controlled emissions at low levels to undergo PSD review, thus extending the time needed for permit approval. To determine the potential effects of air quality regulations upon future geothermal energy development, Federal PSD and non-attainment regulations are examined. The proximity of known geothermal resource areas to Class I PSD areas and non-attainment areas are determined. Atmospheric modeling of H_2S emissions from a hypothetical geothermal plant finds that if recently available control equipment is installed, H_2S emissions do not constrain geothermal development.

1507 By-products

REFER ALSO TO CITATION(S) 7231

1508 Geothermal Power Plants

REFER ALSO TO CITATION(S) 7459

1509 Geothermal Engineering

7460 **(SAND—83-0844) Foam drainage.** Kraynik, A.M. (Sandia National Labs., Albuquerque, NM (USA)). Nov 1983. Contract AC04-76DP00789. 47p. NTIS, PC A03/MF A01. Order Number DE84004137.

Transient drainage from a column of persistent foam has been analyzed theoretically. Gravity-driven flow was assumed to occur through an interconnected network of Plateau borders that define the edges of foam cells taken to be regular pentagonal dodecahedrons. A small liquid volume fraction and monodisperse cell size distribution were assumed. In the basic model, it is assumed that all liquid is contained in Plateau borders that are bounded by rigid gas-liquid interfaces. The predicted half life, the time required for one half of the liquid to drain from the foam, is inversely proportional to the square of the cell diameter, illustrating the importance of foam structure in drainage. Liquid hold up in the films separating adjacent cells, nonuniform initial liquid volume fraction distribution and interfacial mobility are explored. Border suction due to reduced pressure in the Plateau borders provides a mechanism for film drainage. Simultaneous film drainage and flow through the Plateau borders are analyzed. Sufficient conditions for neglecting film drainage kinetics are obtained. The results indicate that improved foam stability is related to small cells, liquid hold up in the films and slow film drainage kinetics.

1510 Direct Energy Utilization

7461 **(DOE/CS/24362—T1) Union County - La Grande, Oregon geothermal district heating: feasibility assessment. Final report.** Jenkins, H. II; Giddings, M.; Hanson, P. (Union County Planning Dept., La Grande, OR (USA)). Sep 1982. Contract AI01-81CS24362. 99p. NTIS, PC A05/MF A01. Order Number DE84004555.

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This report presents an assessment of geothermal district heating in the City of La Grande, Oregon. Eight study area districts were analyzed to determine their economic feasibility. Results from the analyses conclude that certain districts within the City of La Grande are economically feasible if certain assumptions are correct. Development of geothermal district heating for these areas would provide direct energy and dollar savings to the building owners and would also provide direct and indirect benefits to low and moderate income households within the City.

7462 **(DOE/CS/24362—T10) Geothermal district heating system feasibility analysis, Thermopolis, Wyoming.** Goering, S.W.; Garing, K.L.; Coury, G.; Mickley, M.C. (Coury and Associates, Lakewood, CO (USA)). 26 Apr 1982. Contract AI01-81CS24362. 90p. NTIS, PC A05/MF A01. Order Number DE84004622.

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The purpose of this study is to determine the technical and economic feasibility of constructing and operating a district heating system to serve the residential, commercial, and public sectors in Thermopolis. The project geothermal resource assessment, based on reviews of existing information and data, indicated that substantial hot water resources likely exist in the Rose Dome region 10 miles northeast of Thermopolis, and with quantities capable of supporting the proposed geothermal uses. Preliminary engineering designs were developed to serve the space heating and hot water heating demands for buildings in the Thermopolis-East Thermopolis town service area. The heating district design is based on indirect geothermal heat supply and includes production wells, transmission lines, heat exchanger units, and the closed loop distribution and collection system necessary to serve the individual customers. Three options are presented for disposal of the cooled waters-reinjection, river disposal, and agricultural reuse. The preliminary engineering effort indicates the proposed system is technically feasible. The design is sized to serve 1545 residences, 190 businesses, and 24 public buildings. The peak design meets a demand of 128.2 million Btu at production rates of 6400 gpm.

7463 **(DOE/CS/24362—T15) Berlin, Maryland, district heating assessment program. Feasibility study.** (Ebasco Services, Inc., New York (USA)). Sep 1982. Contract AI01-81CS24362. 151p. NTIS, PC A08/MF A01. Order Number DE84004719.

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Ebasco conducted the technical and economic portion of this study to determine the feasibility of constructing a district heating system with a geothermal energy source for the town of Berlin, Maryland. The Berlin District Heating Assessment Work Group (DHAWG) provided the information on the energy needs of all potential users. Previous work was used to estimate the potential geothermal energy available beneath the town. A computer program, GRITS, developed by JHU was also used to evaluate various district heating systems that would satisfy the town's needs. It is concluded that a district heating system is technically and economically feasible based on the criteria and data used in this study.

7464 **(DOE/CS/24362—T19) Berlin, Maryland district heating assessment project.** (Department of Housing and Urban Development, Washington, DC (USA)). [nd]. Contract AI01-81CS24362. 27p. NTIS MF A01. Order Number DE84004702.

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The feasibility of a geothermal district heating system was explored with emphasis on environmental impacts. Alternative energy sources, economic impact, and institutional factors are discussed. The cost of the wells caused the project to be shelved for the present. (MHR)

1520 Geothermal Data And Theory

REFER ALSO TO CITATION(S) 7446, 7451, 7452

17 WIND ENERGY

7465 **(DOE/CE—0048) Wind energy systems program summary, fiscal years 1981 and 1982.** (Applied Solar Engineering, Inc., San Antonio, TX (USA)). Jan 1983. 219p. NTIS, PC A10/MF A01. Order Number DE84002958.

This program summary provides an overview of the Federal Wind Energy program activities during Fiscal Years (FY) 1981 and 1982. It highlights the research, development, and support efforts undertaken and describes individual projects funded by the Department of Energy (DOE) during these fiscal years. The summary includes: a review of program progress to date; program organization and functional responsibilities; program elements and budget; project summaries of major contracts; and a list of key FY 1981 and 1982 wind energy publications. Research and development sponsored by the Federal Wind Energy Program in FY 1981 and 1982 focused on: improving wind system designs and technologies; evaluating the performance of prototype machines; and investigating the availability and utilization of the wind resource.

1706 Wind Energy Engineering

REFER ALSO TO CITATION(S) 7411

7466 **(DOE/NASA/20320—56) Use of the WEST-1 wind turbine simulator to predict blade fatigue load distribution.** Janetzke, D.C. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1983. Contract AI01-76ET20320. 12p. (NASA-TM—83532; CONF-830631—13). NTIS, PC A02/MF A01. Order Number DE84004144.

From 6. biennial wind energy conference; Minneapolis, MN, USA (1 Jun 1983).

The WEST-1 wind turbine simulator is an implementation of mathematical models for an aeroelastic horizontal-axis wind turbine rotor using current hybrid electronics technology. High-speed digital and analog circuitry enable the computation of complex dynamic characteristics and performance of a wind turbine in real time. To test the ability of WEST-1 to predict blade fatigue load distribution, actual wind signals were fed into the simulator and the response data were recorded and processed in the same manner as actual wind turbine data. The WEST-1 simulator was operated in a stable, unattended mode for six hours. The probability distribution of the cyclic flatwise bending moment for the blade was comparable to that for an actual wind turbine in winds with low turbulence. The input from a stationary anemometer was found to be inadequate for use in the prediction of fatigue load distribution for blade design purposes and modifications are necessary.

7467 **(NE-VIND—83-12) Some methods of transient analysis of asynchronous generators as wind generators.** von Zweygbergk, S.; Hallenius, K.E.; Carlson, O.; Hylander, J. (Naemnden foer Energiproduktionsforskning, Stockholm (Sweden)). Dec 1982. 45p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84750107.

The following models of analysis are presented: Analysis by special vectors. Analysis of a fixed three-phase stator and a fixed two-phase rotor. Analysis of a three-phase stator and a three-phase rotating rotor (two modes), and analysis of a fixed three-phase stator and a fixed three-phase rotor.

20 ELECTRIC POWER ENGINEERING

7468 **Instrumentation in the power industry. Volume 25.** Research Triangle Park, NC; Instrument Society of America (1982). 291p. (CONF-8205228—). Instrument Society of America, 67 Alexander Dr., P.O. Box 12277, Research Triangle Park, NC 27709.

From 25. ISA power instrumentation symposium on instrumentation in the power industry; Phoenix, AZ, USA (24 May 1982).

The 27 papers are arranged under the following session headings: instrumentation and control applications; user adjustments to technology advancement; role of I and C in improving reliability, availability, and maintenance; future developments of I and C systems; role of I and C in power plant modernization; and role of I and C in power plant modernization/optimization. (DLC)

2001 Power Plants And Power Generation

REFER ALSO TO CITATION(S) 7172, 7178, 7473, 7709, 7732, 7946

7469 **(CONF-840201—5) Characterization of pressurized fluidized bed and pulverized coal fired power plants.** Doss, H.S.; Pietruszkiewicz, J.; Thomas, G.O.; Hamm, J.R.; Bezella, W.A. (Bechtel Group, Inc., San Francisco, CA (USA); Westinghouse Research and Development Center, Pittsburgh, PA (USA); Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 17p. NTIS, PC A02/MF A01. Order Number DE84003675.

From ASME energy sources technology conference and exhibition; New Orleans, LA, USA (12 Feb 1984).

This paper presents the major technical and economic characteristics of a steam-cooled and an air-cooled pressurized fluidized bed (PFB) power plant concept along with the characteristics of a pulverized coal fired power plant equipped with an adipic acid enhanced wet-limestone flue gas desulfurization system. The conceptual designs were prepared to satisfy a set of common groundrules that were developed for the study. The power plants are of the grassroots type, located on a generic plant site. The designs incorporate technological advances available for commercialization in the 1990 time frame. The net power outputs of the base case plants, using Illinois No. 6 coal, range from 502 MWe for the pulverized coal fired plant to 554 MWe for the air-cooled PFB plant. The net power plant heat rates vary from 9725 Btu/kWh for the pulverized coal fired plant to 8710 Btu/kWh for the steam-cooled PFB plant. For the economic groundrules set for the study, the pulverized coal fired plant utilizing an advanced flue gas desulfurization concept had the lowest specific capital cost and lowest levelized cost of electricity. However, utility and site specific conditions could materially alter the relative merits of the various concepts in a given utility application.

7470 **(INIS-mf—8232) Pressure loss and heat transfer studies performed on axial-flow finned-tube bundle heat exchangers.** Boltendahl, U. (Technische Hochschule Aachen (Germany, F.R.). Fakultaet fuer Maschinenwesen). 22 May 1981. 119p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE83703955.

The experimental studies intend to determine the dependence on the parameters of influence state of flow, tube length, and bundle pitch of the heat transfer and pressure loss characteristic of two tube types in the bundle. By means of suitable parameters for heat flow and pressure loss a comparison will be made of the heat transfer and pressure loss power of the axial-flow furried-tube bundle systems investigated here and conventional heat exchangers.

2002 Environmental Aspects

REFER ALSO TO CITATION(S) 7137, 8548, 8549, 8563, 8639

2003 Power Transmission And Distribution

7471 **(BMFT-FB-T—83-165) Testing of the box transformer 10/0.4 kV in the network of the electricity supply company.** Cichowski, R.; Nickling, G. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Aug 1983. 44p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84750047.

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The box transformer 10/0.4 kV is a new operating element, whose practical possibilities of application had to be studied using twelve prototypes in a distribution network within a test phase. Theoretically new network conceptions and network forms resp. have been developed for this. The regional areas of application for the 12 prototypes of the box transformers have been chosen network regarding technique, authorization law and supply technique. Furthermore, different realization forms of the box transformers (single-phase and triplet-phase resp.) have been studied and the experience with respect to the installation of these new operating elements have been analyzed. First operational results of the single projects and a consideration of the costs for the system box transformer complete the study.

7472 **(BNL—33608) 60 Hz performance of superconducting power transmission cables rated for 333 MVA per phase.** Forsyth, E.B. (Brookhaven National Lab., Upton, NY (USA)). 1984. Contract AC02-76CH00016. 11p. (CONF-840112—1). NTIS, PC A02/MF A01. Order Number DE84000536.

From IEEE Power Engineering Society winter meeting; Dallas, TX, USA (29 Jan 1984).

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For the past year two 115 meter-long superconducting power transmission cables have been tested at Brookhaven. These cables are the culmination of about a decade of development and are the largest application of superconductivity to power engineering up to the present. Performance data for 60 Hz excitation up to 6000 A and 110 kV are given.

7473 **(NP—3770161) Contribution to the application of the reliability theory in electric energy supply.** Roske, H. (Technische Univ. Berlin (Germany, F.R.). Fachbereich Elektrotechnik). 15 Jan 1982. 133p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE83770161.

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After the author has described the possibilities of determining the reliability data of components from the failure mode statistics some general methods for the determination of the systems reliability are demonstrated. The most important result is the fact that the highest annual probability of the compensation deficit does not occur in the months of peak load but on account of unit revisions in the seasons of transition.

21 NUCLEAR POWER PLANTS

7474 **(INIS-mf—8603) Annual report 1982-83 [of the Department of Atomic Energy, India].** (Department of Atomic Energy, Bombay (India)). 1983. 58p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE83704769.

The annual report of the Department of Atomic Energy (DAE) of the Government of India for the financial year 1982-83 surveys the work of its various establishments. The major thrust of the DAE's programme is directed towards peaceful uses of atomic energy - primarily for electric power generation and applications of radiation and radioisotopes in medicine, agriculture and industry. The Bhabha Atomic Research Centre at Bombay is the major R and D establishment of the DAE and its activities in the fields of nuclear physics, chemistry and materials science, radiochemistry, nuclear fuels, reactor engineering, radiation protection, radioactive waste management and applications of radiation and radioactive isotopes are described in detail. The R and D activities of the Reactor Research Centre at Kanpakkam, the Tata Institute of Fundamental Research and the Tata Alemorial Centre, both at Bombay, and the Saha Institute of Nuclear Physics at Calcutta are described in brief. The performance of the Tarapur Atomic Power Station, the Rajasthan Atomic Power Station, the Nuclear Fuel Complex at Hyderabad, the Atomic Minerals Division, Uranium Corporation of India Ltd at Jaduguda, various heavy water plants and other industrial units of DAE is reported. Progress of nuclear power projects at Narora and Kakrapar, R-5 Project at Bombay and FBTR Project at Kalpakkam is described. India's participation in the activities of the International Atomic Energy Agency is also mentioned. (M.G.B.).

7475 (INIS-mf—8649, pp 13-35) **Nuclear plant and the fission cycle.** Goedkoop, J.A. (Stichting Energieonderzoek Centrum Nederland, Petten). 1982. (In Dutch). NTIS (US Sales Only), PC A08/MF A01. (CONF-8205225—).

From Conference on nuclear energy - what do you know about it; Enschede, Netherlands (11 May 1982).

This paper is a simple and clear Dutch text which presents the working principles of the nuclear reactor and describes the construction and operation of the Dutch nuclear centres, which both have light water reactors. The fission cycle is explained and the following more advanced types of reactor in use in other countries are

briefly discussed: heavy water reactors, graphite moderated reactors, sodium cooled fast breeder reactors.

2101 Power Reactors, Non-breeding, Light-water Moderated, Boiling Water Cooled

REFER ALSO TO CITATION(S) 7542, 7596, 7599, 7600, 7601, 7603, 7604, 7605, 7609, 7612, 7613, 7615, 7616, 7617, 7627, 7629, 7647, 7851, 7852

7476 (ANL—83-99) Analysis of cracked core spray injection line piping from the Quad Cities Units 1 and 2 boiling water reactors. Diercks, D.R. (Argonne National Lab., IL (USA)). Dec 1983. Contract W-31-109-ENG-38. 65p. NTIS, PC A04/MF A01. Order Number DE84004888.

Elbow assemblies and adjacent piping from the loops A and B core spray injection lines of Quad Cities Units 1 and 2 Boiling Water Reactors have been examined in order to determine the nature and causes of coolant leakages and flaw indications detected during hydrostatic tests and subsequent ultrasonic inspections. The elbow assemblies were found to contain multiple intergranular cracks in the weld heat-affected zones. The cracking was predominantly axial in orientation in the forged elbow and wedge components, whereas mixed axial and circumferential cracking was seen in the wrought piping pieces. In at least two instances, axial cracks completely penetrated the circumferential weld joining adjacent components. Based upon the observations made in the present study, the failures were attributed to intergranular stress corrosion cracking caused by the weld-induced sensitized microstructure and residual stresses present; dissolved oxygen in the reactor coolant apparently served as the corrosive species. The predominantly axial orientation of the cracks present in the forged components is believed to be related to the banded microstructure present in these components. The metallographic studies reported are supplemented by x-radiography, chemical analysis and mechanical test results, determinations of the degree of sensitization present, and measurements of weld metal delta ferrite content.

7477 (ANSI/ANS—56.7-1978) American National Standard: for boiling water reactor containment ventilation systems. (American Nuclear Society, La Grange Park, IL). 30 Mar 1978. 30p. American Nuclear Society, 555 North Kensington Ave., La Grange Park, IL 60525 $32.00.

The purpose of this standard is to establish minimum requirements for design, installation, testing and maintenance for ventilation systems serving the containment of boiling water reactors (BWRs). For purposes of this standard, containment is construed to include all structures with the following functions: (1) capable of withstanding the initial peak and long-term pressure and temperature resulting from a design basis event; (2) providing a primary, essentially leak-tight barrier (primary reactor containment) against fission products released from the reactor coolant pressure boundary as a result of a design basis event (DBE); and (3) providing a secondary containment against release of those fission products to the environment. The systems included are those that supply, recirculate and exhaust air, and provide air treatment where necessary to ensure the health and safety of operating personnel and of the general public during normal operation and during DBE conditions. Treatment systems may be shared with other structures of the plant. This standard does not include either (1) pressure suppression systems for the automatic attenuation of the pressure surge resulting from a break in the reactor coolant pressure boundary, or (2) combustible gas control systems (such as recombiners) for reducing overall buildup of combustible gases in the containment atmosphere following a DBE. The standard does not specify the types of containment ventilation systems to be used in BWRs.

7478 (ANSI/ANS—57.3-1983) American National Standard: design requirements for new fuel storage facilities at light water reactor plants. (American Nuclear Society, La Grange Park, IL). 1983. 15p. American Nuclear Society, 555 North Kensington Ave., La Grange Park, IL 60525 $17.00.

This standard defines the required functions of wet or dry storage facilities for new fuel at light water reactor nuclear power plants. It provides minimum design requirements for safe storage of new nuclear fuel and control components at such plants. The fuel storage facilities covered by this standard are used for receiving, inspecting and storing fuel containing new and recycled uranium and mixed oxides. The basis of this standard is that the intended function of the facilities will be performed in an efficient and economical manner to (a) preclude criticality, (b) ensure protection to new fuel assemblies, control components, plant personnel, and the public, and (c) maintain radiation exposures as low as reasonably achievable.

7479 (ANSI/ANS—57.5-1981) American National Standard: for light water reactors fuel assembly mechanical design and evaluation. (American Nuclear Society, La Grange Park, IL). 14 May 1981. 21p. American Nuclear Society, 555 North Kensington Ave., La Grange Park, IL 60525 $24.00.

This standard establishes a procedure for performing an evaluation of the mechanical design of fuel assemblies for light water-cooled commercial power reactors. It does not address the various aspects of neutronic or thermal-hydraulic performance except where these factors impose loads or constraints on the mechanical design of the fuel assemblies. The standard provides definition of design conditions. It also presents a list of functional requirements representing the general attributes of fuel assemblies. This standard also includes a set of specific requirements for design, various potential performance problems and criteria aimed specifically at averting them.

7480 (EGG-M—21083) TRAC-BWR heat transfer. Shumway, R.W. (Idaho National Engineering Lab., Idaho Falls (USA)). 1983. Contract AC07-76ID01570. 5p. (CONF-8310143—66). NTIS, PC A02/MF A01. Order Number DE84002215.

From 11. NRC water reactor safety research information meeting; Gaithersburg, MD, USA (14 Oct 1983).

The Idaho National Engineering Laboratory has been developing a boiling water reactor (BWR) version of the TRAC code. The purpose of the heat transfer part of the code development is to develop a best estimate package and assure that heat transfer processes important for predicting off-normal BWR transients are adequately characterized by the heat transfer logic in the code. Another purpose is to identify where experimental data is lacking.

7481 (GEAP—23773) Demonstration of fuel resistant to pellet-cladding interaction. First semiannual report, July-December 1977. Rosenbaum, H.S. (comp.). (General Electric Co., San Jose, CA (USA). Nuclear Energy Engineering Div.). Feb 1978. Contract AC02-77QQ04473. 163p. NTIS, PC A08/MF A01. Order Number DE84004977.

Objective is the demonstration od advanced fuel concepts that are resistant to the failure mechanism known as fuel pellet-cladding interaction (PCI). Since currently used fuel in the nuclear power industry is subject to the PCI failure mechanism, reactor operators limit the rates of power increases and thus reduce their capacity factors in order to protect the fuel. Two barrier concepts are being prepared for demonstration: (a) Cu-Barrier fuel and (b) Zr-Liner fuel. The large-scale demonstration of the PCI-resistant fuel is being designed generically to show feasibility of such a demonstration in a commercial power reactor of type BWR/3 having a steady-state core. Using the core of Quad Cities-1 reactor at the beginning of Cycle 6, the insertion of the demonstration PCI-resistant fuel and the reactor operational plan are being designed. Support laboratory tests to date for the Demonstration have shown that these barrier fuels (both the Cu-Barrier and the Zr-Liner types) are resistant to PCI. Four lead test assemblies (LTA) of the advanced PCI-resistant fuel are being fabricated for insertion into the Quad Cities-1 Boiling Water Reactor at the beginning of Cycle 5 (January 1979).

7482 (INIS-mf—8583) Use of plutonium in Swedish reactors. Forsstroem, H. (Svensk Kaernbraensleforsoerjning AB, Stockholm). Sep 1982. 62p. (In Swedish). NTIS (US Sales Only), PC A04/MF A01. Order Number DE83703956.

The report deals with the utilization of plutonium in Swedish nuclear power plants. The plutonium content of the mixed oxide

fuel will normally be 3-7 per cent. The processing of spent nuclear fuel will produce about 6 tons of plutonium. The use of mixed oxide fuel in Forsmark 3 and Oskarshamn 3 is discussed. The fuel cycle will start with the manufacturing of the fuel elements abroad and proceeds with transport and utilization, storing of spent fuel about 40 years in Sweden followed by direct disposal. The manufacture and use of mixed oxide (MOX) fuel is based on well-known techniques. Approximately 20,000 MOX fuel rods have been irradiated and the fuel is essentially equivalent to uranium oxide fuel. 30-50 per cent of the core may be composed of MOX-fuel without any effect on the operation and safety of the reactor which has been originally designed for uranium fuel. The evaluation of international fuel cycle (INFCE) states that the proliferation risks are very small. The recycling of plutonium will reduce demand for enriched uranium and the calculations show that 6.3 ton plutonium will replace the enrichment of 600 ton natural uranium.

7483 **(UCID—19724) Technical evaluation report on the electrical, instrumentation, and control design aspects of the proposed license amendment revision 1 for single-loop operation of the Pilgrim Nuclear Power Station, Unit 1 (Docket No. 50-293).** Donich, T.R. (Lawrence Livermore National Lab., CA (USA)). 14 Dec 1983. Contract W-7405-ENG-48. 7p. NTIS, PC A02/MF A01. Order Number DE84004597.

This report documents the technical evaluation of the proposed changes to the plant reactor protection system by the licensee of Pilgrim Nuclear Power Station, Unit 1, to account for single-loop plant operation. This evaluation is restricted to only the electrical, instrumentation, and control design aspects of proposed changes to the plant technical specifications for single-loop operation beyond 24 hours. The conclusion of the evaluation is that the Pilgrim Nuclear Power Station, Unit 1, license amendment for single-loop opertion has met the review criteria provided anomalous control room indications are corrected or warning-tagged for the duration of single-loop operations and the title or position of the appropriate technical individual to make the independent check of the setpoint adjustment be identified.

2102 Power Reactors, Non-breeding, Light-water Moderated, Non-boiling Water Cooled

REFER ALSO TO CITATION(S) 7478, 7479, 7520, 7542, 7559, 7575, 7576, 7596, 7598, 7601, 7603, 7604, 7605, 7615, 7616, 7617, 7622, 7626, 7627, 7628, 7629, 7630, 7631, 7632, 7647, 7652, 7852

7484 **(ANSI/ANS—56.6-1978) American National Standard: pressurized water reactor containment ventilation systems.** (American Nuclear Society, La Grange Park, IL). 8 Nov 1978. 27p. American Nuclear Society, 555 North Kensington Ave., La Grange Park, IL 60525 $25.00.

This standard encompasses the ventilation systems including equipment, piping, ductwork and control devices utilized for providing heat removal, heating, atmospheric cleanup, and general ventilation within pressurized water reactor containment structures. It includes systems which are used to ventilate containment structures even though the systems are physically located outside containment. This standard defines the design requirements of such equipment and systems and gives basic requirements and system arrangements with due consideration for construction, fabrication, surveillance, maintenance, and operation. This standard does not include liquid spray systems, closed water systems, or process support systems for subatmospheric or ice condenser containments. This standard is based upon the systems engineering criteria presented in American National Standard Nuclear Safety Criteria for the Design of Stationary Pressurized Water Reactor Plants, N18.2-1973/ANS-51.1.

7485 **(CEA-CONF—6705) Study by the disco method of critical components of a P.W.R. normal feedwater system.** Duchemin, B.; Villeneuve, M.J. de; Vallette, F.; Bruna, J.G. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Mar 1983. 12p. (CONF-8303104—1). NTIS (US Sales Only), MF A01. Order Number DE84750238.

From 4. Eurodata conference; Venice, Italy (23 Mar 1983). Microfiche only, copy does not permit paper copy reproduction.

The DISCO (Determination of Importance Sensitivity of Components) method objective is to rank the components of a system in order to obtain the most important ones versus availability. This method uses the fault tree description of the system and the cut set technique. It ranks the components by ordering the importances attributed to each one. The DISCO method was applied to the study of the 900 MWe P.W.R. normal feedwater system with insufficient flow in steam generator. In order to take account of operating experience several data banks were used and the results compared. This study allowed determination the most critical component (the turbo-pumps) and to propose and quantify modifications of the system in order to improve its availability.

7486 **(CEA-CONF—6716) Is it possible to improve regulation system of PWR.** Bonnemay, A.; Martinez, J.M. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Mar 1983. 24p. (CONF-830318—8). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750239.

From 5. power plant dynamics control and testing symposium; Knoxville, TN, USA (21 Mar 1983).

This paper deals with two problems. First of all, it presents the critical analysis of usually implemented general regulation systems, on PWR plants, and derives from it some possibilities to improve the transient behavior of reactors. The second part is a proposition for an automatic control system for spatial distribution of flux.

7487 **(DOE/ET/34212—38) Fuel performance under extended-burnup operation: B and W 15x15 design.** Dideon, C.G.; Bain, G.M. (Babcock and Wilcox Co., Lynchburg, VA (USA)). Sep 1983. Contract AC02-78ET34212. 142p. (BAW—1716). NTIS (US Sales Only), PC A07/MF A01. Order Number DE84002334.

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The objective of this Department of Energy-sponsored program is to demonstrate the extended-burnup performance of Babcock and Wilcox-designed pressurized water reactor fuel and support extending the burnup of light water reactor fuel from 33,000 to 38,000 MWd/mtU on a routine basis. This report summarizes both the physical response and core performance of the standard Mark B 15x15 fuel assembly to extended-burnup operation based on the results of nondestructive and destructive post-irradiation examinations after three (31,000 MWd/mtU) and four (40,000 MWd/mtU) cycles of operation. The Mark B assemblies in this program have been irradiated to 40,000 MWd/mtU in Duke Power Company's Oconee Unit 1 reactor; a four cycle (40,000 MWd/mtU-burnup) Mark B assembly is currently being irradiated for a fifth cycle in the same reactor to achieve a burnup of 50,000 MWd/mtU. Post-irradiation examinations have been conducted both on-site in Oconee's spent fuel pool and at Babcock and Wilcox's hot cell facility. Results of examinations of fuel with burnups through 40,000 MWd/mtU have not only shown that the fuel has performed well but also have confirmed that even higher burnups can be attained. Further, core parameters that may be affected by extended burnup have been determined to be non-limiting for high-burnup operation. Areas that could limit burnup are: (1) irradiation-produced dimensional changes, (2) cladding waterside corrosion, (3) fission gas release, and (4) pellet-cladding interaction. However, based on the performance data base to date, the Mark B fuel assembly without design alterations can operate to a burnup of 43,000 MWd/mtU.

7488 **(EGG-TMI—6443) TMI cable tracer operation and maintenance manual for assembly 417910.** Sumstine, R.L. (EG and G Idaho, Inc., Idaho Falls (USA)). Nov 1983. Contract AC07-76ID01570. 53p. NTIS, PC A04/MF A01. Order Number DE84004945.

Portions are illegible in microfiche products.

This manual provides technical information and instructions to operate and maintain the cable tracer designed for the Three Mile Island (TMI) Unit 2 Reactor Building. The TMI cable tracer was developed to allow TMI personnel to trace cables in cable trays that may be tested or sectioned for destructive examination.

7489 **(FEI—1276) EREBUNI: energy distribution in an NPP unit reactor with regard to neutron measurements. Pt. 2. Computer code.** Goryunov, V.K. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1982. 14p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704154.

The correction program for physical calculation of energy yield fields by measurement results in the separate reactor assemblies is described. The correction is performed with regard to spatial correlations of physical calculation errors. The described program version for field calculation in (r-phi)-geometry is oriented on WWER type reactors.

7490 **(INIS-mf—8642, pp 46) Study of uranium release from fuel to primary circuit coolant of WWER-440 type power plant.** Burclova, J. (Vyskumny Ustav Jadrovych Elektrarni, Jaslovske Bohunice (Czechoslovakia)). May 1983. (In Czech). NTIS (US Sales Only), PC A04/MF A01. (CONF-8305140—Absts.).

From Conference on instrumental activation analysis - IAA 83; Klucenice, Czechoslovakia (30 May 1983).

7491 **(ITEF—52(1982)) Calculating the actinide production in the WWER-440 reactor during nuclear fuel reutilization.** Zaritskaya, T.S.; Rudik, A.P. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1982. 27p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83704159.

A possibility of reutilization of nuclear fuel unloaded from the WWER type reactors is analyzed on the base of the results of calculation of the actinide production in the WWER-440 reactor. A combined iterative method is used to calculate nuclear fuel burnup and actinide production. A tree-zone model, in which a central zone is field with a fuel, an intermediate zone is a zirconium fuel can and an external zone is the coolant, is considered. An initial uranium composition is the following: ^{235}U-3.6%, ^{236}U-0.431%, ^{238}U-95.7%. It is supposed that 47.6 t of UO_2 generate the power of 84.5 MWt/m^3. It corresponds to the initial thermal neutron flux being equal to $15x10^{13}$ neutron/cm^{3}xs. The data characterizing the fission product accumulation as a function of a period of the time from the reactor start up, the neutron spectra hadrness time dependence and production of ^{237}Np, plutonium isotopes, ^{243}Am, ^{244}Cm are obtained. Basing on the comparison of the data obtained with the results of calculation of actinide production during single fuel cycle a conclusion is made that ^{235}U burnup increases rather slowly and sufficiently greater amount of ^{237}Np is produced during nuclear fuel reutilization in.

7492 **(JAERI-M—82-064) PWRDYN: a computer code for PWR plant dynamic analysis.** Yokobayashi, Masao. (Japan Atomic Energy Research Inst., Tokyo). Jun 1982. 67p. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE83704199.

This report describes analytical models and calculated results of a PWR plant dynamic analysis code PWRDYN. The code has been developed in order to analyze and evaluate transient responses for small disturbance such as operating mode change and control system characteristic analysis. The features included in PWRDYN are 1) one loop approximation of primary loops, 2) primary coolant is always subcooled, 3) at the secondary side of steam generator is used one dimensional model and natural circulation is calculated assuming constant by positive driving head, and 4) main control systems are incorporated. In the transient responses caused by small perturbation, the calculated results by PWRDYN are in good agreement with the RETRAN calculations. Furthermore, computing time is very short so as about one seventh of real time, hence the code is convenient and useful for dynamic analysis of PWR plants.

7493 **(NUREG/CR—3502) High dryout quality film boiling and steam cooling heat transfer data from a rod bundle.** Yoder, G.L.; Anklam, T.M.; Morris, D.G.; Mullins, C.B. (Oak Ridge National Lab., TN (USA)). Dec 1983. Contract W-7405-ENG-26. 94p. (ORNL/TM—8794). NTIS, PC A05/MF A01 - GPO. Order Number DE84004700.

A series of eight steady-state rod bundle tests has been performed in the Thermal Hydraulic Test Facility to gather data in both the low flow film boiling region and high flow steam cooling region. This test series includes experiments both with and without liquid entrainment above the dryout point. Bundle fluid conditions were calculated using steady-state energy and mass conservation equations. The experimental heat transfer data have been compared to several film boiling heat transfer correlations and one vapor correlation. Results of these comparisons support the conclusions reached in the analysis of prior ORNL transient and steady-state tests (3.03.6AR, 3.06.6B, 3.08.6C, series 3.07.9, series 3.02.10, and series 3.09.10). Results indicate that the Dougall-Rohsenow correlation often overpredicts the heat transfer coefficient, while the Groeneveld 5.7 and Condie-Bengston IV correlations tend to underpredict, however, they are in better agreement with the data. The Groenveld-Delorme correlation underpredicts heat fluxes. The Dittus-Boelter correlation was evaluated only when equilibrium qualities were greater than one, and tends to overpredict the heat transfer coefficient.

7494 **(ORNL—5891) Restarting TMI unit one: social and psychological impacts.** Sorensen, J.; Soderstrom, J.; Bolin, R.; Copenhaver, E.; Carnes, S. (Oak Ridge National Lab., TN (USA)). Dec 1983. Contract W-7405-ENG-26. 249p. NTIS, PC A11/MF A01. Order Number DE84004107.

A technical background is provided for preparing an environmental assessment of the social and psychological impacts of restarting the undamaged reactor at Three Mile Island (TMI). Its purpose is to define the factors that may cause impacts, to define what those impacts might be, and to make a preliminary assessment of how impacts could be mitigated. It does not attempt to predict or project the magnitude of impacts. Four major research activities were undertaken: a literature review, focus-group discussions, community profiling, and community surveys. As much as possible, impacts of the accident at Unit 2 were differentiated from the possible impacts of restarting Unit 1. It is concluded that restart will generate social conflict in the TMI vicinity which could lead to adverse effects. Furthermore, between 30 and 50 percent of the population possess characteristics which are associated with vulnerability to experiencing negative impacts. Adverse effects, however, can be reduced with a community-based mitigation strategy.

7495 **Quality assurance at the Midland nuclear powerplant. Oversight hearing before the Subcommittee on Energy and the Environment of the Committee on Interior and Insular Affairs, House of Representatives, Ninety-Eighth Congress, First Session.** Washington, DC; Government Printing Office (1983). 177p.

Regulators, utility officers, labor leaders, and consumers testified on the breakdown of quality assurance at the Midland, Michigan construction site. Their assessments range from poor recordkeeping to serious safety defects in the design and construction of the two units. John Selby, President and Chief Executive Officer of Consumers Power Co. gave an overview of the project and regulatory problems, specifically the improper compaction of soils in the excavation. A panel of intervenors presenting citizen concerns and requesting remedies was followed by a panel of union officials defending the performance of construction workers. Additional material submitted for the record follows the testimony. (DCK)

2103 Power Reactors, Non-breeding, Graphite Moderated

REFER ALSO TO CITATION(S) 7543, 7544, 7545, 7603, 7621, 7635, 7636, 7637, 7638, 7639, 7640, 7641, 7642, 7643, 7644, 7656

7498 **(CONF-830996—1) Status of HTGR technology development and demonstration.** Trauger, D.B. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 7p. NTIS, PC A02/MF A01. Order Number DE84003310.

From Annual international conference on the high-temperature gas-cooled reactor; San Diego, CA, USA (29 Sep 1983).

Several HGTR items which require thorough testing include the core support and pads, vessel insulation and liner, and graphite fuel blocks. Tests which are to be conducted in the Component Flow Test Loop are discussed. The neutron streaming experiment at the Tower Shielding Facility is described. Materials and fuels development studies are also discussed. (DLC)

7497 **(GA-A—17110) HTGR Fuel Technology Program. Semiannual report for the period ending March 31, 1983.** (GA Technologies, Inc., San Diego, CA (USA)). Jul 1983. Contract AT03-76ET35300. 113p. NTIS, PC A06/MF A01. Order Number DE84003974.

This document reports the technical accomplishments of the HTGR Fuel Technology Program at GA Technologies Inc. during the first half of FY 83. The activities include the fuel process, fuel materials, fuel cycle, fission product transport, core component verification, and core technology transfer tasks necessary to support the design and development of a steam cycle/cogeneration (SC/C) version of the HTGR.

7498 **(JAERI-M—82-058) FLOSA: a computer program to design core restraint mechanism for experimental VHTR under earthquake.** Iyoku, Tatsuo; Motoki, Yasuo. (Japan Atomic Energy Research Inst., Tokyo). Jun 1982. 52p. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE83704198.

A computer code FLOSA has been developed to design core restraint mechanism of a experimental Very-High Temperature Gas-Cooled Reactor (VHTR) under earthquake. It deals with band type and link-coil spring type as a core restraint mechanism. The basic purposes of FLOSA are: (1) to analyze seismic induced forces on components of core restraint mechanism and tangential keys, (2) to calculate displacements of permanent reflector blocks, (3) to evaluate influence of gaps existing in the link contact points. Sample problems are considered for band type core restraint mechanism in the System Total Design and for link-coil spring type in the Detailed Design (I).

7499 **(JAERI-M—82-085) Postirradiation examination of V1F-11H capsule.** Kikuchi, Teruo; Ikawa, Katsuichi. (Japan Atomic Energy Research Inst., Tokyo). Jul 1982. 45p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83704160.

Reduced size fuel compacts for HTGR were irradiated in VT-1 irradiation hole of JRR-2 for 2 cycles (about 22 days) at 700 to 1400°C. Irradiation induced dimensional changes of fuel compacts were 1 to 4 x 10^{-3}. The ratios of fission product concentration in the highest concentration region of the sleeve to the concentration in the fuel compact located at the corresponding position were 3.8 x 10^{-4}, 1.3 x 10^{-3} and 2.5 x 10^{-6} for ^{144}Ce, ^{125}Sb and ^{137}Cs, respectively. The failure fraction of coated particles in fuel compacts was 3 x 10^{-6} or less. The thermal nuetron flux obtained from Al-Co fluence monitor was about a half of the value obtained by the activation analysis of gold foils in VT-1 irradiation hole.

7500 (NUREG/CP—0045-Vol.1, pp 23-60) **Current status of VHTR development in Japan.** Aochi, A.; Kondo, T. (Japan Atomic Energy Research Inst., Tokyo). 1982. NTIS, PC A14/MF A01 - GPO. (CONF-820650—Vol.1; BNL-NUREG—51674-Vol.1).

From 3. Japan/US HTGR safety technology seminar; Upton, NY, USA (2 Jun 1982).

The status of the program at the beginning of fiscal 1982 is reviewed. Special emphasis is placed on the altering of the output helium temperature of the experimental VHTR to 950°. The modification is aimed at establishing the technical basis for post-experimental VHTR output helium temperature of 1000°C. Notes are given on the design of the VHTR as well as various research and development efforts in Japan on multi-purpose nuclear heat applications and HTGR technology.

7501 (NUREG/CP—0045-Vol.1, pp 76-91) **Fort St. Vrain reactor performance and operation to full power.** Simon, W.A.; Bramblett, G.C. (General Atomic Co., San Diego, CA). 1982. NTIS, PC A14/MF A01 - GPO. (CONF-820650—Vol.1; BNL-NUREG—51674-Vol.1).

From 3. Japan/US HTGR safety technology seminar; Upton, NY, USA (2 Jun 1982).

The Fort St. Vrain Nuclear Generating Station, powered by a high-temperature gas-cooled reactor (HTGR), has now been tested to full thermal power. Testing was conducted for the dual purposes of demonstrating component and system capability as a part of the rise-to-power program and determining core fluctuation/redistribution behavior under full power conditions. Both objectives were met. Full power performance of all major components and the achievement of nearly all design objectives has been verified. In addition, the tests showed that the fluctuation phenomenon has been corrected. Core region outlet temperature redistributions have been characterized, related to a physical mechanism, and shown to be inconsequential for overall plant operation.

7502 (NUREG/CP—0045-Vol.1, pp 231-239) **Thermal and hydrodynamic analysis of the refueling stand pipe under normal and accidental conditions.** Kudo, A.; Yamaguchi, S.; Yatabe, H. (Babcock Hitachi K.K., Hiroshima-Ken, Japan). 1982. NTIS, PC A14/MF A01 - GPO. (CONF-820650—Vol.1; BNL-NUREG—51674-Vol.1).

From 3. Japan/US HTGR safety technology seminar; Upton, NY, USA (2 Jun 1982).

The effect of natural convection on the gas temperature distribution inside the refueling stand pipe for the experimental VHTR is investigated numerically. The analysis is carried out using a computer program which solves continuity, momentum, and energy equations in finite difference form. The results show: (1) The gas temperature exceeds the limiting value of the internal structure when the lower region of the stand pipe is not thermally insulated. (2) The gas temperature can be maintained below the limiting value under both normal and accidental conditions when the lower region is thermally insulated.

7503 (NUREG/CP—0045-Vol.1, pp 240-250) **Development and application of the HTGR-GT code for system transients of an HTGR with gas turbine.** Kroeger, P.G. (Brookhaven National Lab., Upton, NY). 1982. NTIS, PC A14/MF A01 - GPO. (CONF-820650—Vol.1; BNL-NUREG—51674-Vol.1).

From 3. Japan/US HTGR safety technology seminar; Upton, NY, USA (2 Jun 1982).

An exploratory code for the thermohydraulic dynamics of the primary loop of a direct cycle HTGR with gas turbine is described. Several sample applications are given.

7504 (NUREG/CP—0045-Vol.1, pp 251-260) **Static and transient characteristics of the shaft seal system for helium gas circulator (Part 1).** Morohoshi, S.; (Nagasaki Tech. Inst., Japan); Saki, K.; Nemoto, M.; Taniguchi, S.; Sugimoto, A.; Kojima, M. 1982. NTIS, PC A14/MF A01 - GPO. (CONF-820650—Vol.1; BNL-NUREG—51674-Vol.1).

From 3. Japan/US HTGR safety technology seminar; Upton, NY, USA (2 Jun 1982).

A development program of the shaft seal system for the helium circulator supported by water lubricated bearings is presented. A seal system simulating tester and a computer program which can simulate the transient characteristics of a buffer gas seal system were newly introduced, and an investigation was performed experimentally and analytically of the characteristics of water and gas seals and of the buffer gas seal system including the control system.

Main results are as follows: (1) Water seals were especially investigated in detail, and it was found that turbulence in water flow through seal clearance and deformation of seal components affected the leakage characteristics of water seals. They should be considered not only to make safety design but also to get optimum design of the seal system. (2) The calculation method for transient response of the buffer gas seal system including the control system was developed. This digital simulating method can well simulate transients encountered in the tester, and it would make a powerful tool for developing a safe seal system under steady state operation conditions and at depressurization accidents in a reactor.

7505 (UNI—2288) **Compact tension specimens for N Reactor pressure tube fracture toughness tests.** Scott, K.V. (UNC Nuclear Industries, Inc., Richland, WA (USA)). 30 Dec 1982. Contract AC06-76RL01857. 35p. NTIS, PC A03/MF A01. Order Number DE84003578.

This report presents the results of a test program used to validate the use of compact tension specimens to determine the fracture toughness of N-Reactor pressure tubes. Plane strain fracture toughness tests using compact tension specimens were conducted on material from a previously tested pressure tube. The results were very consistent and proved the ability of this method to determine the fracture toughness of pressure tubes. This test method is more accurate and precise than the burst type test, which has been used in the past.

7506 **Waste heat gas utilization for HTGR gas turbine plant for sea water desalination.** Hunter, D.A.A. Sao Paulo, Brazil; Institut de Pesquisas Energeticas e Nucleares (1981). 145p. (In Portuguese). IPEN, Sao Paulo, Brazil.

A thermodynamic analysis is performed for a HTGR - Gas Turbine Plant, coupled with a Rankine cycle for additional power generation and/or desalination of sea water with a multistage flash evaporator. Three basic alternatives are studied: a) Brayton cycle with inter-cooling and without regeneration, coupled with a Rankine cycle for power generation and steam for evaporator. b) Same as a) but without inter-cooling and with regeneration. c) Brayton cycle with regeneration, without inter-cooling, coupled with a Rankine cycle for sea water evaporator steam generation. The behavior of the three alternatives is established with a parametric study for the most representative variables. Economy, safety and control aspects were considered for the three different conceptions.

2105 Power Reactors, Breeding

REFER ALSO TO CITATION(S) 7238, 7542, 7553, 7571, 7608, 7610, 7611, 7623, 7624, 7634, 7653, 7698, 7843, 7844, 9192

7507 (CEA-N—2349) **IAEA Specialist meeting on advances in structural analysis for LMFBR applications. Pt.1. Summary report.** Perez, M.A.; Roche, R.L. (eds.). (CEA, 75 - Paris (France)). May 1983. 292p. (In English and French). (CONF-8210221—). NTIS (US Sales Only), MF A01. Order Number DE84750178.

From IAEA specialist meeting on advances in structural analysis for LMFBR applications; Paris, France (11 Oct 1982).

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After the first session on review of national positions in the subject field, the meeting was divided into five technical sections as follows: general methods of structural analysis for elevated temperatures; inelastic analysis methods for elevated temperature; effects of cyclic loading; design codes and criteria; and, instability and buckling, piping analysis in the creep range. Separate abstracts were preapred for the papers presented.

7508 (CEA-N—2349, pp 1) **Development of fast neutron reactors in France. 2. part; Invited lecture.** Petit, J. May 1983. (In English and French). NTIS (US Sales Only), MF A01. (CONF-8210221—).

From IAEA specialist meeting on advances in structural analysis for LMFBR applications; Paris, France (11 Oct 1982).

In France, a conjugated strategy involving EDF (a government owned organization), the CEA (which develops fast reactors and carries out R and D studies) and industry has been adopted aimed at achieving a significant fast reactor participation (5 to 10%) in the generation of nuclear electricity by the beginning of the next century. This strategy is based on a coherent and carefully defined development program launched in 1930, each new stage of which is only decided upon after the results of the preceeding stage have been analyzed. The different stages of fast reactor research and development are outlined.

7509 (CEA-N—2349, pp 13) **Contribution of the CEC in structural analysis applied to LMFBR problems. Part. 3; Position papers.** Larsson, L.H.; Terzaghi, A. May 1983. NTIS (US Sales Only), MF A01. (CONF-8210221—).

From IAEA specialist meeting on advances in structural analysis for LMFBR applications; Paris, France (11 Oct 1982).

This paper presents both the activity of DG XII (Directorate General for Science Research and Development) in field of Codes and Standards (harmonization) and the research activity carried out at the JRC in Ispra. The first part describes the activity performed in the field of structural analysis by the Fast Reactor Coordinating Committee of the CEC and its working Group Codes and Standards. This activity is aimed at resolving difficulties encountered in using design procedures based on ASME Code Case N-47. In the second part of the paper results of recent research and future plans in the area of structural mechanics at the JRC Ispra are discussed. In the past years, a large effort was devoted to the COVA (code validation) program intended to validate dynamic fluid/structure codes; the main conclusions are presented. The paper then describes the identification technique which is applied for the determination of constitutive equations for the dynamic behaviour of materials. In the field of fracture mechanics JRC has mostly concentrated its efforts on the elastic-plastic fracture toughness properties of irradiated austenitic steels.

7510 (CEA-N—2349, pp 6) **German position paper on structural analysis for LMFBR applications. Part. 3; Position papers.** Angerbauer, A.; Link, F. May 1983. NTIS (US Sales Only), MF A01. (CONF-8210221—).

From IAEA specialist meeting on advances in structural analysis for LMFBR applications; Paris, France (11 Oct 1982).

During the design period of the German LMFBR, the SNR-300, extensive work had been done in the field of elastic and inelastic analysis. Furthermore, special design rules have been developed. These activities are outlined herein.

7511 (CEA-N—2349, pp 24) **Structural analysis for LMFBR applications. Part. 3; Position papers.** Vaze, M.K.K. May 1983. NTIS (US Sales Only), MF A01. (CONF-8210221—).

From IAEA specialist meeting on advances in structural analysis for LMFBR applications; Paris, France (11 Oct 1982).

The use of elastic analysis for structural design of LMFBR components is discussed. The elastic analysis methods have been used for structural design of the Fast Breeder Test Reactor as well as the proposed Prototype Fast Breeder Reactor. The design of Fast Breeder Test Reactor which is nearing completion is same as that of Rapsodie. Nevertheless, the design had to be checked against the latest design codes available, namely the ASME Code case 1592. This paper, however, is confined to structural analysis of PFBR components. The problems faced in the design of some of the components, in particular, the inner vessel (plenum separator) are discussed. As far as design codes are concerned, ASME Code Section III and the Code Case N-47 are used for high temperature design. The problems faced in the use of these rules are also described along with the description of analysis. Studies in the field of cyclic loading include extension of Bree's shakedown and plastic cycling criteria for ratchet free operation to biaxial stress fields.

7512 (CEA-N—2349, pp 23) **Problems deriving from the application of rules in the designing of thick and thin wall pipelines in the field of high temperatures. Part. 3; Position papers.** Cesari, F.G.; Menghini, S.; Regis, V.; Antoni, A. May 1983. NTIS (US Sales Only), MF A01. (CONF-8210221—).

From IAEA specialist meeting on advances in structural analysis for LMFBR applications; Paris, France (11 Oct 1982).

The first part of this study is an evaluation of the rules or an attempt to apply them both in the field of design operating loads in a pipeline for thermoelectric power plants in the ASME loading categories and in the field of by limitress classification by this analysis aims at determining the possible safety margin which can be obtained through the various rules. The second part of this analysis briefly evaluates some deficiencies of the ASME rules as to the thickness of bends; it also estimates the impact that these deficiencies in the rules may have on the plan. The ASME Section III, Code Case no 47, one of the main design codes in the field of fast reactors, is discussed. The basic problems found in the design of the primary cooling circuits of the PEC facility are analysed.

7513 (CEA-N—2349, pp 7) **Overview of current activities relevant to structural analysis on LMFBR in Japan. Part. 3; Position papers.** Ichimiya, M. May 1983. NTIS (US Sales Only), MF A01. (CONF-8210221—).

From IAEA specialist meeting on advances in structural analysis for LMFBR applications; Paris, France (11 Oct 1982).

The structural analysis activities on LMFBR in Japan have been made mainly toward the validation of the rules of high temperature structural design guide which is to be used for the design of class 1 components for elevated temperature service of the prototype fast breeder reactor, Monju. In addition, buckling analyses were performed considering the thin structures with low internal pressure in Monju components. Further test and analysis were made on ratcheting.

7514 (CEA-N—2349, pp 11) **UK contribution to the IWGFR specialists meeting on advances in structural analysis for LMFBR applications. Part. 3; Position papers.** Goodall, I.W.; Jobson, D.A.; Rose, R.T. May 1983. NTIS (US Sales Only), MF A01. (CONF-8210221—).

From IAEA specialist meeting on advances in structural analysis for LMFBR applications; Paris, France (11 Oct 1982).

This article makes reference to some of the work done in the UK. The work reviewed has been grouped under following headings: structural analysis at elevated temperatures (simplified methods); inelastic analysis methods for elevated temperatures; the effects of cyclic loading; piping analysis in the creep range; and design codes and criteria.

7515 (CEA-N—2349, pp 5) **Some comments about structural analysis applied to LMFBR. Part. 3; Position papers.** Roche, R.L.; Vouilloux, F.; Lucenet. May 1983. NTIS (US Sales Only), MF A01. (CONF-8210221—).

From IAEA specialist meeting on advances in structural analysis for LMFBR applications; Paris, France (11 Oct 1982).

In France, structural analysis for LMFBR applications is strongly related to design, construction and operation of existing or planned fast reactor plants. Structural analysis applied to LMFBR is brievly reviewed and discussed.

7516 (CEA-N—2349, pp 11) **References and figures for verbal presentations given on behalf of UK delegation. Part. 4; Contributions - Session 1.** Rose, R.T. May 1983. NTIS (US Sales Only), MF A01. (CONF-8210221—).

From IAEA specialist meeting on advances in structural analysis for LMFBR applications; Paris, France (11 Oct 1982).

7517 (CEA-N—2349, pp 6) **Approximate methods and working rules for peak stress effects. Part. 4; Contributions - Session 1.** Jobson, D.A. May 1983. NTIS (US Sales Only), MF A01. (CONF-8210221—).

From IAEA specialist meeting on advances in structural analysis for LMFBR applications; Paris, France (11 Oct 1982).

7518 (CEA-N—2349, pp 9) **Strain evaluation in fatigue analysis. Part. 4; Contributions - Session 1.** Cabrillat, M.T.; Carbonnier, J.L. May 1983. NTIS (US Sales Only), MF A01. (CONF-8210221—).

From IAEA specialist meeting on advances in structural analysis for LMFBR applications; Paris, France (11 Oct 1982).

Several elastic and plastic calculations on typical geometries, have been done in order to test the importance of parameters taking into account non-linearity of materials and triaxiality and isovolumic character of strains in the plastic field and to set up methods for evaluating the respective coefficients Ke.

7519 (CEA-N—2349, pp 7) **Development validation and use of computer codes for inelastic analysis. Part. 4; Contributions - Session 1.** Jobson, D.A. May 1983. NTIS (US Sales Only), MF A01. (CONF-8210221—).

From IAEA specialist meeting on advances in structural analysis for LMFBR applications; Paris, France (11 Oct 1982).

7520 (CEA-N—2349, pp 7) **Structural mechanics studies at E.D.F. Part. 4; Contributions - Session 2.** Baylac, G. May 1983. NTIS (US Sales Only), MF A01. (CONF-8210221—).

From IAEA specialist meeting on advances in structural analysis for LMFBR applications; Paris, France (11 Oct 1982).

Structural mechanics studies at E.D.F. are made with three goals: a better knowledge of the materials properrties, an improvement of the design, a better in-service surveillance of the components.

7521 (CEA-N—2349, pp 14) **Tube sheet structural analysis of intermediate heat exchanger for fast breeder reactor "Monju". Part. 4; Contributions - Session 3.** Nakagawa, Y.; Ueno, T.; Fukuda, Y.; Ichimiya, M. May 1983. NTIS (US Sales Only), MF A01. (CONF-8210221—).

From IAEA specialist meeting on advances in structural analysis for LMFBR applications; Paris, France (11 Oct 1982).

The Prototype Fast Breeer Reactor "Monju" is the first power generating fast breeder reactor in Japon. We have been designing the components of the plant for manufacturing. Among these is the intermediate heat exchanger (IHX) which exchanges heat between primary and secondary sodium loop. The tube sheet of IHX (shell to ligament junction) is a difficult area from the view point of structural strength design under elevated temperature. To validate the structural integrity of tube sheet we performed the series of inelastic analysis and tube sheet thermal shock test using test pieces and half scale model of actual design. The results of inelastic analyses showed there is little progressive deformation around shell to ligament structural discontinuous junction. Furthermore, thermal shock tests showed no increase of an accumulative deformation. By these analyses and experiments, structural relability of tube sheet could be shown.

7522 (CEA-N—2349, pp 8) **RAMSES committee rules for the analysis of mechanical structures at elevated temperatures. Part. 4; Contributions - Session 4.** Moulin, D.; Tortel, J.; Carbonnier, J.L. May 1983. NTIS (US Sales Only), MF A01. (CONF-8210221—).

From IAEA specialist meeting on advances in structural analysis for LMFBR applications; Paris, France (11 Oct 1982).

The Ramses Committee was created by the C.E.A. in order to write down rules for the design of french pool type LMFBR The development of new rules is now effective and a complete network of rules based on elastic calculation is available (Ramses 30.015 and Ramses 40.729). Actions are still carrying on to increase the efficiency of the present rules; under consideration are mainly creep-fatigue and buckling risk evaluations.

7523 (CEA-N—2349, pp 4) **Calculational and experimental studies of BR-5 (10) sodium circuit components working capabilities. Part. 4; Contributions - Session 4.** Kruchkov, E.A.; Kruglov, A.S.; Mosolov, V.V.; Piskunov, V.N.; Rineokii, A.A. May 1983. NTIS (US Sales Only), MF A01. (CONF-8210221—).

From IAEA specialist meeting on advances in structural analysis for LMFBR applications; Paris, France (11 Oct 1982).

Material research and calculational studies of more than 20 test specimens of metal cut out from the most representative primary circuit sections after its 20 year operation have confirmed serviceability of material. The paper presents the results of investigations and their method.

7524 (CEA-N—2349, pp 7) **Outline of structural design guide for class 1 components of prototype fast breeder reactor for elevated temperature service. Part. 4; Contributions - Session 4.** Ichimiya, M. May 1983. NTIS (US Sales Only), MF A01. (CONF-8210221—).

From IAEA specialist meeting on advances in structural analysis for LMFBR applications; Paris, France (11 Oct 1982).

The basics of the high temperature structural design guide consists of the following nine items. (1) Conformance with current domestic legal rules. (2) Reference to foreign high temperature structural design standards. (3) Consideration of failure modes to be prevented. (4) Application of the results obtained from the research and development activities. (5) Specification of design method. (6) Evaluation of environmental effects. (7) Consideration for the inherent design features of Monju. (8) Incorporation of the guide line of allowable stresses for seismic loads. (9) Incorporation of material strength tables.

7525 (CEA-N—2349, pp 18) **Buckling evaluation of components for fast breeder reactor "Monju". Part. 4; Contributions - Session 5.** Nakagawa, Y.; Ueno, T.; Ishizaki, T.; Fukuda, Y.; Ichimiya, M. May 1983. NTIS (US Sales Only), MF A01. (CONF-8210221—).

From IAEA specialist meeting on advances in structural analysis for LMFBR applications; Paris, France (11 Oct 1982).

Thin shell and large diameter components are distinctive features of fast breeder reactor (FBR). For these structures, evaluations of buckling are very important. This paper describes analytical and experimental evaluations of main structures of FBR. Straight tube buckling of intermediate heat exchanger and buckling of cylindrical shell with a circular opening are studied.

7526 (CEA-N—2349, pp 1) **Stress indices and flexibility factors in thin elbows. Part. 4; Contributions - Session 5.** Berton, M.N.; Carbonnier, J.L. May 1983. NTIS (US Sales Only), MF A01. (CONF-8210221—).

From IAEA specialist meeting on advances in structural analysis for LMFBR applications; Paris, France (11 Oct 1982).

Usually piping calculations are done with a beam model. Ovalization in elbows is taken into account by the mean of flexibility factors and stress indices. This paper compares results from a beam model calculation with results from a 3 D shell model calculation (Codes TEDEL and TRICO from the CEA-SEMT System). The aim of this comparison is to study validity of the stress indices and flexibility factors used in the beam model for several kinds of loading.

7527 (CEA-N—2349, pp 12) **Evaluations of stress concentration at girth butt weld joint between straight pipe and elbow. Part. 4; Contributions - Session 5.** Mizuno, S. May 1983. NTIS (US Sales Only), MF A01. (CONF-8210221—).

From IAEA specialist meeting on advances in structural analysis for LMFBR applications; Paris, France (11 Oct 1982).

Stresses in weld joint due to ovalization of elbow, are represented by "carrry over factor". In this paper, the factors at the girth weld joint are studied; two piping models are analyzed to establish the factors for use in Monju piping design. To evaluate the stress concentrations for Monju main piping, measurement tests were performed concerning trial production for Monju. The FEM (Finite Element Method) program MARC was used to analyze. To obtain the radial shrinkage for Monju main piping, measurement tests were performed by using mocked up pipe and elbow assemblies. Finally, the design factors proposed in this study are presented.

7528 (CEA-N—2349, pp 4) **Approximate analyses of inelastic effects in pipework. Part. 4; Contributions - Session 5.** Jobson, D.A. May 1983. NTIS (US Sales Only), MF A01. (CONF-8210221—).

From IAEA specialist meeting on advances in structural analysis for LMFBR applications; Paris, France (11 Oct 1982).

7529 (CEA-N—2349, pp 2) **Inelastic analysis of SNR-300 piping. Part. 4; Contributions - Session 5.** Huebel, H.; Di Luna, L.J.; Moy, G. May 1983. NTIS (US Sales Only), MF A01. (CONF-8210221—).

From IAEA specialist meeting on advances in structural analysis for LMFBR applications; Paris, France (11 Oct 1982).

This paper investigates plasticity, creep, and elastic follow-up effects on a full size hot primary piping system of the German fast breeder reactor prototype, the SNR-300. A large model (327 elements, 419 nodes) of straight pipe, special elbow and hangar elements of the general purpose finite element program, MARC-CDC, is used to predict piping behavior for a heat-up, sodium loading-unloading-reloading cycle and other significant operating conditions. Included in this work are many time-dependent solution increments for a 5,000 hour creep period. Creep strains and relaxed stress results, after 5,000 hours, for the complete model are used with uniaxial and biaxial models and results to extrapolate conclusions for a 100,000 hour operating life.

7530 (CEA-N—2349, pp 7) **Main results of BN 600 reactor stress-strain state investigations. Part. 4; Contributions - Session 5.** Panov, V.A. May 1983. NTIS (US Sales Only), MF A01. (CONF-8210221—).

From IAEA specialist meeting on advances in structural analysis for LMFBR applications; Paris, France (11 Oct 1982).

The development of BN 600 fast reactor plant necessitated the solution of a series of complex engineering problems including ones for confirming integrity of the most vital structural components. The particular attention was given to the main vessel since reactor availability and safe operation of the plant as a whole depend on vessel strength and integrity. The present report deals with the main results of theoretical and experimental investigations of the stress-strain state of BN 600 reactor vessel carried out during design, start-up and initial bringing to power.

7531 (CONF-830905—9) **CRBRP steam-generator design evolution.** Geiger, W.R.; Gillett, J.E.; Lagally, H.O. (Westinghouse Electric Corp., Madison, PA (USA). Advanced Energy Systems Div.). 1983. Contract AC15-76CL50003. 10p. NTIS MF A01. Order Number DE84001850.

From Joint power generation conference; Indianapolis, IN, USA (25 Sep 1983).

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The overall design of the CRBRP Steam Generator is briefly discussed. Two areas of particular concern are highlighted and considerations leading to the final design are detailed. Differential thermal expansion between the shell and the steam tubes is accommodated by the tubes flexing in the curved section of the shell. Support of the tubes by the internals structure is essential to permit free movement and minimize tube wear. Special spacer plate attachment and tube hole geometry promote unimpeded axial movement of the tubes by allowing individual tubes to rotate laterally and by providing lateral movement of the spacer plates relative to the adjacent support structure. The water/steam heads of the CRBRP Steam Generator are spherical heads welded to the lower and upper tubesheets. They were chosen principally because they provide a positively sealed system and result in more favorable stresses in the tubesheets when compared to mechanically attached steam-heads.

7532 (DOE/ET/37240—101TR) **Criteria for the onset of mixed convection and onset of recirculation in vertical rod bundles.** Symolon, P.D.; Todreas, N.E.; Rohsenow, W.M. (Massachusetts Inst. of Tech., Cambridge (USA)). Nov 1983. Contract AC02-76ET37240. 297p. NTIS, PC A13/MF A01. Order Number DE84003191.

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Criteria were developed for the onset of recirculation and onset of mixed convection in vertical rod bundles. It was concluded that the dominant mechanisms governing mixed convection in rod bundles are the frictional and buoyancy forces. By balancing these two terms, the key dimensionless parameters were identified as Re and B^*. The criteria was expressed in terms of a flow regime map of Re versus B^*. It was found that the onset of mixed convection could be predicted with forced convection input parameters, but for the onset of recirculation the effect of buoyancy on mixing was important.

7533 **(HEDL-SA—2960) Pipe supports and anchors - LMFBR applications.** Anderson, M.J. (Hanford Engineering Development Lab., Richland, WA (USA)). Jun 1983. Contract AC06-76FF02170. 43p. NTIS, PC A03/MF A01. Order Number DE84001496.

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Pipe design and support design can not be treated as separate disciplines. A coordinated design approach is required if LMFBR pipe system adequacy is to be achieved at a reasonable cost. It is particularly important that system designers understand and consider those factors which influence support train flexibility and thus the pipe system dynamic stress levels. The system approach must not stop with the design phase but should continue thru the erection and acceptance test procedures. The factors that should be considered in the design of LMFBR pipe supports and anchors are described. The various pipe support train elements are described together with guidance on analysis, design and application aspects. Post erection acceptance and verification test procedures are then discussed.

7534 **(HEDL-SA—2966) Large-component handling equipment and its use.** Krieg, S.A.; Swannack, D.L. (Hanford Engineering Development Lab., Richland, WA (USA)). 2 Jun 1983. Contract AC06-76FF02170. 6p. (CONF-830905—11). NTIS, PC A02/MF A01. Order Number DE84001497.

From Joint power generation conference; Indianapolis, IN, USA (25 Sep 1983).

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The Fast Flux Test Facility (FFTF) reactor systems have special requirements for component replacements during maintenance servicing. Replacement operations must address handling of equipment within shielded metal containers while maintaining an inert atmosphere to prevent reaction of sodium with air. Plant identification of a failed component results in selecting and assembling the maintenance cask and equipment transport system for transfer from the storage facility to the Reactor Containment Building (RCB). This includes a proper diameter and length cask, inert atmosphere control consoles, component lift fixture and support structure for interface with the facility area surrounding the component. This equipment is staged in modular groups in the Reactor Service Building for transfer through the equipment airlock to the containment interior. The failed component is generally prepared for replacement by installation of the special lifting fixture attachment. Assembly of the cask support structure is performed over the component position on the containment building operating floor. The cask and shroud from the reactor interface are inerted after all manual service connections and handling attachments are completed. The component is lifted from the reactor and into the cask interior through a floor valve which is then closed to isolate the component reactor port. The cask with sodium wetted component is transferred to a service/repair location, either within containment or outside, to the Maintenance Facility cleaning and repair area. The complete equipment and handling operations for replacement of a large reactor component are described.

7535 **(JAERI-M—82-071) Application of a hexagonal element scheme in the finite element method for three-dimensional diffusion problems of fast reactors.** Ishiguro, Misako; Higuchi, Kenji. (Japan Atomic Energy Research Inst., Tokyo). Jul 1982. 61p. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE83704201.

In treating neutron diffusions the finite difference method has been used. But it is expected that the finite element method is applicable for treating the awkward shapes and/or for the problems whose computing accuracy is unsatisfied by the finite difference method. Here, we extend the existing finite element diffusion code FEM.BABEL for treating the hexagonal-shaped array which is a typical geometry in fast reactors, where we adopt a new element scheme "hexagonal element". In the report, described are (1) applicability of the finite element method, (2) finite element approximation for the neutron diffusions, (3) hexagonal element function, (4) treatment of inhomogeneous subassembly, (5) mesh generation of the hexagonal array, (6) extension of the code, (7) comparison of the computing times.

7536 **(JAERI-M—82-084) Gas-cooled fast breeder reactor.** Yoshida, Hiroyuki. (Japan Atomic Energy Research Inst., Tokyo). Jul 1982. 72p. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE83704161.

Almost all the R D works of gas-cooled fast breeder reactor in the world were terminated at the end of the year 1980. In order to show that the R D termination was not due to technical difficulties of the reactor itself, the present paper describes the reactor plant concept, reactor performances, safety, economics and fuel cycle characteristics of the reactor, and also describes the reactor technologies developed so far, technological problems remained to be solved and planned development schedules of the reactor.

2106 Power Reactors, Auxiliary, Mobile, Package, And Transportable

REFER ALSO TO CITATION(S) 7571

7537 **(GULF-GA-A—12608) Development of a thermionic-reactor space-power system. Final summary report.** (Gulf General Atomic Co., San Diego, CA (USA)). 30 Jun 1973. Contract AT03-76SF72017. 516p. NTIS, PC A22/MF A01. Order Number DE83018296.

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Initial experimental work led to the award of the first AEC thermionic contract on May 1, 1962, for the development of fission heated thermionic cells with an operating life of 10,000 hours or more. Two types of converters were fabricated: (1) electrically heated, and (2) fission heated where the fuel was either uranium carbide or uranium oxide. Competition between GGA and GE was climaxed on July 1, 1970 by the award to GGA of a contract to develop an in-core thermionic reactor. This report is divided into the following: thermionic research, materials technology, thermionic fuel element development, reactor technology, and systems technology.

7538 **Direct-energy-conversion implications of Space Nuclear Reactors.** Morris, J.F. (Arizona State University, Tempe, AZ). *Proceedings, Intersociety Energy Conversion Engineering Conference;* **4**: 1902-1907(Aug 1982). (CONF-820814—).

From 17. Intersociety Energy Conversion Engineering conference; Los Angeles, CA, USA (8 Aug 1982).

The Air Force, NASA and DOE stress space-nuclear reactor (SNR) needs in 1981 IECEC papers. SNR proposals range from 10-to-100kW /SUB e/,s with thermoelectrics through the fractional-to-several MW /SUB e/ 's with thermionic conversion to rotating bed-reactor (RBR) and NERVA ultraversions. SNR direct conversion comprises thermionic and thermoelectric generation (TEG). Thermionic energy conversion (TEC) pervades the pre-1973 in-core and out-of-core-heat-pipe concepts. SPAR and SP-100 focus on thermoelectrics because of ostensible fuel-temperature limits. A Rasor Associates mini-heat-pipe reactor verifies again the high-power capability of this SNR type--as well as TEC advantages over TEG. Finally with about 2000K effluents, directly from RBR's, NERVA's or from MHD used with them, TEC could also produce very high power levels. This paper outlines SNR needs, discusses some proposed concepts and recommends future technology programs.

2107 Regulation And Licensing

REFER ALSO TO CITATION(S) 7701, 7709

2108 Economics

REFER ALSO TO CITATION(S) 7260

7539 **(ANSI/ANS—3.5-1981) American National Standard: nuclear power plant simulators for use in operator training.** (American Nuclear Society, La Grange Park, IL). 1981. 13p. American Nuclear Society, 555 North Kensington Ave., La Grange Park, IL 60525 $16.00.

This standard establishes the minimum functional requirements for nuclear power plant simulators for use in operator training. Simulators for test, mobile and research reactors, as well as reactors not subject to the US Nuclear Regulatory Commission (NRC) licensing, and limited scope simulators intended for specialized training or familiarization are excluded. Minimum functional criteria are established for degree of simulation, performance and functional capability of the control room instrumentation and controls. The criteria for use of such simulators are not addressed in this standard.

7540 (INIS-mf—8649, pp 99-108) **Is nuclear energy really so cheap.** Damveld, H. 1982. (In Dutch). NTIS (US Sales Only), PC A08/MF A01. (CONF-8205225—).

From Conference on nuclear energy - what do you know about it; Enschede, Netherlands (11 May 1982).

Dutch industry does not use electricity from nuclear energy and is said to be at a disadvantage as regards costs compared to other countries. The author considers in a simple and clearly written Dutch text whether electricity production via a nuclear power plant is as inexpensive as claimed. The article is in two parts; part one examines the cost of electricity production from nuclear centres compared to current electricity prices and concludes that although the prices charged for nuclear energy abroad are certainly lower, the cost of producing nuclear energy abroad is not lower than the average price paid for electricity by Dutch industry. The second part considers the costs associated with the following aspects of future nuclear centres: construction time; investment; insurance; starting-up; efficiency factor; storage of nuclear waste; depreciation; dismantlement. Calculations by the author indicate that nuclear power is 10 to 70% more expensive than electricity generated from coal.

7541 (INIS-mf—8649, pp 109-129) **Cost price of a kWh(e).** Blaauw, H.J. 1982. (In Dutch). NTIS (US Sales Only), PC A08/MF A01. (CONF-8205225—).

From Conference on nuclear energy - what do you know about it; Enschede, Netherlands (11 May 1982).

The author compares in a simple and clearly written Dutch text the cost price of a kWh of electrical energy produced in power plants fed by fossil fuels and by uranium. He emphasises the method of calculation rather than the results, leaving the reader to judge the value of a number of existing studies. He first explains how the cost price can be split into three parts for investment, exploitation and fuel costs and then calculates the further sub-divisions of these costs giving constant comparisons with calculations by other authors.

7542 (K/OP—299-Pt.1) **Evaluation of nuclear fuel reprocessing strategies. 1. Nuclear power expansion prospects and the transition to breeders.** Prince, B.E.; Hadley, S.W. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). 15 Nov 1982. Contract W-7405-ENG-26. 82p. NTIS, PC A05/MF A01. Order Number DE84004905.

This is the first of two reports which reexamine the strategic basis for closing the LWR fuel cycle and extending technology developments to the breeder fuel cycle. This document focuses on the prospects for reemergence of an expansion phase in the nuclear power industry following the current period of plant construction cutbacks. The implications of such an expansion on the need for transition to breeders and the plutonium fuel cycle is examined. The discussion consists, in large measure, of a critical review of arguments already given in various other sources; however, supplementary analysis is also provided to help put these arguments in context. A strong effort is made to view these issues from a broad perspective of the national interest.

2109 Process Heat Reactors

REFER ALSO TO CITATION(S) 7656

7543 (NUREG/CP—0045-Vol.1, pp 173-203) **Reduced risk HTGR concept for industrial heat application.** Boardman, C.E.; Lipps, A.J. (General Electric Co., Sunnyvale, CA). 1982. NTIS, PC A14/MF A01 - GPO. (CONF-820650—Vol.1; BNL-NUREG—51674-Vol.1).

From 3. Japan/US HTGR safety technology seminar; Upton, NY, USA (2 Jun 1982).

The industrial process heat market has been identified as major market for the High Temperature Gas-Cooled Reactor (HTGR), however, this market introduces stringent availability requirements on the reactor system relative to electric plants which feed a large existing grid. The characteristics and requirements of the industrial heat markets are summarized; the risks associated with serving this market with a single large HTGR will be discussed; and the modular concept, which has the potential to reduce both safety and investment risks, will be described. The reference modular concept described consists of several small, relatively benign nuclear heat sources linked together to supply heat energy to a balance-of-plant incorporating a process gas train/thermochemical pipe line system and a normal steam-electric plant.

7544 (NUREG/CP—0045-Vol.1, pp 204-214) **Safety study on nuclear heat utilization system - accident delineation and assessment on nuclear steelmaking pilot plant.** Yoshida, T. (Ishikawajima-Harima Heavy Industries Co., Ltd., Tokyo, Japan); Mizuno, M.; Tsuruoka, K. 1982. NTIS, PC A14/MF A01 - GPO. (CONF-820650—Vol.1; BNL-NUREG—51674-Vol.1).

From 3. Japan/US HTGR safety technology seminar; Upton, NY, USA (2 Jun 1982).

This paper presents accident delineation and assessment on a nuclear steelmaking pilot plant as an example of nuclear heat utilization systems. The reactor thermal energy from VHTR is transported to externally located chemical process plant employing helium-heated steam reformer by an intermediate heat transport loop. This paper on the nuclear steelmaking pilot plant will describe (1) system transients under accident conditions, (2) impact of explosion and fire on the nuclear reactor and the public and (3) radiation exposure on the public. The results presented in this paper will contribute considerably to understanding safety features of nuclear heat utilization system that employs the intermediate heat transport loop and the helium-heated steam reformer.

7545 (NUREG/CP—0045-Vol.1, pp 261-288) **New HTGR plant concept with inherently safe features aimed at small energy users needs.** McDonald, C.F.; Silady, F.S.; Shenoy, A.S. (General Atomic Co., San Diego, CA). 1982. NTIS, PC A14/MF A01 - GPO. (CONF-820650—Vol.1; BNL-NUREG—51674-Vol.1).

From 3. Japan/US HTGR safety technology seminar; Upton, NY, USA (2 Jun 1982).

A small high-temperature gas-cooled reactor (HTGR) concept is proposed which could provide the energy needs for certain sectors of industrialized nations and the developing countries. The key to the economic success for small reactors, which have potential benefits for special markets, lies in altering the traditional scaling laws. Toward this goal, a small HTGR concept embodying passive decay heat removal features is currently being evaluated. This paper emphasizes the safety-related aspects of a small HTGR. The proposed small reactor concept is new and still in the design development stage, and a significant effort must be expended to establish a design which is technically and economically feasible and will meet the increasingly demanding safety and licensing goals for reactors of the future.

22 NUCLEAR REACTOR TECHNOLOGY

7546 (ANSI/ANS—19.1-1983) **American National Standard: nuclear data sets for reactor design calculations.** (American Nuclear Society, La Grange Park, IL). 22 Jul 1983. 15p. American Nuclear Society, 555 North Kensington Ave., La Grange Park, IL 60525 $20.00.

This standard identifies and describes the specifications for developing, preparing, and documenting nuclear data sets to be used in reactor design calculations. The specifications include criteria for acceptance of evaluated nuclear data sets, criteria for processing evaluated data and preparation of processed continuous data and averaged data sets, and identification of specific evaluated, processed continuous, and averaged data sets which meet these criteria for specific reactor types.

2201 Theory And Calculation

7547 **(ANSI/ANS—19.3-1983) American National Standard: for the determination of neutron reaction rate distributions and reactivity of nuclear reactors.** (American Nuclear Society, La Grange Park, IL). 1983. 25p. American Nuclear Society, 555 North Kensington Ave., La Grange Park, IL 60525 $30.00.

This standard provides guidance for performing and validating the sequence of calculations leading to prediction, in all types of nuclear reactors of: reaction rate spatial distributions, reactivity, and change of isotopic compositions with time. The standard provides: guidance for the selection of computational methods, criteria for verification of calculational methods used by reactor core analysts, criteria for evaluation of accuracy and range of applicability of data and methods, and requirements for documentation of the preceding.

7548 **(CONF-8310143—15) Validation of neutron-transport calculations in benchmark facilities for improved damage-fluence predictions.** Williams, M.L.; Stallmann, F.W.; Maerker, R.E.; Kam, F.B.K. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 10p. NTIS, PC A02/MF A01. Order Number DE84001968.

From 11. NRC water reactor safety research information meeting; Gaithersburg, MD, USA (14 Oct 1983).

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An accurate determination of damage fluence accumulated by reactor pressure vessels (RPV) as a function of time is essential in order to evaluate the vessel integrity for both pressurized thermal shock (PTS) transients and end-of-life considerations. The desired accuracy for neutron exposure parameters such as displacements per atom or fluence ($E > 1$ MeV) is of the order of 20 to 30%. However, these types of accuracies can only be obtained realistically by validation of nuclear data and calculational methods in benchmark facilities. The purposes of this paper are to review the needs and requirements for benchmark experiments, to discuss the status of current benchmark experiments, to summarize results and conclusions obtained so far, and to suggest areas where further benchmarking is needed.

7549 **(JAERI-M—82-083) Improved power method for solving eigenvalue problems in plant dynamics and control.** Shimazaki, Junya. (Japan Atomic Energy Research Inst., Tokyo). Jul 1982. 51p. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE83704202.

This report describes an improvement of the power method which is applied to solve eigenvalue problems in the analysis of plant dynamics and control. These problems are taken from stability evaluation of an objective plant, modal analysis and modal control, calculation of optimal state-feedback control, and reduction method of dimension of a large-scale dynamical system. Usually there exist only a few modes of poor stability in plant dynamics. To analyze these modes the power method is applied after some modifications. The basic procedure of the method is to calculate first a maximum absolute eigenvalue and the corresponding eigenvector of a matrix, and then the remaining eigenvalues are calculated by the eigenvalue deflation method. The main improvement presented in this report is that the power method has been made applicable in the cases of both nearly equal eigenvalues and confluent ones. The effectiveness of the improved method is shown with some examples of different kinds of eigenvalues which were calculated using the computer code developed based on this method. In addition, the deflation method, which removes the calculated eigenvalue from the matrix and reduces the dimension of the matrix, is discussed in comparison with the ordinary deflation method.

7550 **(JINR-R—11-82-710) Geometrical module for reactor calculation in three-dimensional X-Y-Z geometry by the Monte Carlo method.** Rogov, A.D. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1982. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704155.

A program module for three-dimensional calculation of geometry of reactors and critical assemblies with complicated structure is described. The module is intended for work with the HMKFK program complex. An algorithm for calculation of a particle trajectory in a given geometrical zone is considered. Three subroutines comprised in the module: the DGXYZ subroutine for initial data input, the SSXYZ subroutine for grawing the initial coordinates of a particle series from the given distribution, and the GEOXYZ subroutine for for constructing a particle trajectory are described. The GEOXYZ subroutine of the module is the basic one; it is multiply referred to for the construction of a particle trajectory portion between two collisions. Before reference to the GEOXYZ subroutine, the following data should be given: particle coordinates and direction of flight; optical length of a particle free path between two collisions; particle energy (or energy group number). The module programs are written in the FORTRAN language. The module described enlarges the library of standard modules incorporated in the MMKFK program complex.

7551 (NEANDC—158-U, pp 9-26) **Impact on neutron calculations of the scattering cross section uncertainties for the major actinides.** Palmiotti, G.; Salvatores, M. 1982. (In French). NTIS (US Sales Only), PC A11/MF A01.

In Fast neutron scattering on actinide nuclei.

A study of actinide scattering cross section data uncertainty effects on integral parameters useful for fast power reactor projects is presented. The role of integral experiments and the possible use of a new data adjustement method are examined. The need for improving data in this field is underlined.

2202 Components And Accessories

7552 **(ANSI/ANS—6.4-1977) American National Standard: guidelines on the nuclear analysis and design of concrete radiation shielding for nuclear power plants.** (American Nuclear Society, La Grange Park, IL). 8 Aug 1977. 74p. American Nuclear Society, 555 North Kensington Ave., La Grange Park, IL 60525 $38.00.

This Standard contains methods and data needed to calculate the concrete thickness required for radiation shielding in nuclear power plants. Where possible, specific recommendations regarding radiation attenuation calculations, shielding design, and standards of documentation are made. The standard provides guidance to architect-engineers, utilities, and reactor vendors who are responsible for the shielding design of stationary nuclear plants. This standard does not consider sources of radiation other than those associated with nuclear power plants. It also excludes considerations of economic aspects of shielding design, other than the choice of analytical method. This standard includes a discussion of the nature of concrete, emphasizing those variable aspects of the material which are important to the shield designer. The document discusses methods of analysis and the shielding input data appropriate to each method. Applications of the analytical methods are given, including bulk transport, radiation heating, streaming, and reflection problems.

7553 (CEA-N—2349, pp 6) **Ratchetting experiments on thin cylinders subject to axially moving temperature fronts. Part. 4; Contributions - Session 3.** Bell, R.T. May 1983. NTIS (US Sales Only), MF A01. (CONF-8210221—).

From IAEA specialist meeting on advances in structural analysis for LMFBR applications; Paris, France (11 Oct 1982).

7554 **(CONF-8310143—57) Evaluations of the Irwin β/sub Ic/ adjustment for small specimen fracture toughness data.** Merkle, J.G. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 19p. NTIS, PC A02/MF A01. Order Number DE84003292.

From 11. NRC water reactor safety research information meeting; Gaithersburg, MD, USA (14 Oct 1983).

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When small specimens are used to measure the cleavage fracture toughness of pressure vessel steels in the transition range of temperature, specimen thickness size effects and large amounts of data scatter are often observed. The size effects are manifested by an increase in the average value of fracture toughness with decreasing specimen thickness, eventually resulting in a change in fracture mode from cleavage to ductile tearing. It has been shown that a semiempirical adjustment for the interacting effects of specimen

thickness, yield stress and toughness originally proposed by Irwin is capable of reducing the calculated values of toughness and data scatter to levels consistent with large specimen test data. This is true for dynamic as well as for static initiation toughness values. The nature of the size effect described by the Irwin β/sub Ic/ equation is illustrated and specific cases are shown in which β/sub Ic/ adjustment has eliminated size effects, for both static and dynamic fracture toughness data.

7555 **(CONF-8310166—2) Leakage-flow induced vibrations of a chimney structure suspended in a liquid flow.** Chung, H. (Argonne National Lab., IL (USA)). 1983. Contract W-31-109-ENG-38. 28p. NTIS, PC A03/MF A01. Order Number DE84003618.

From 54. shock and vibration symposium; Pasadena, CA, USA (18 Oct 1983).

This paper presents the results of flow-induced vibration tests conducted to assess the vibration characteristics of a chimney structure suspended in a liquid flow. The test article is a full-scale model of a flow chimney used in a nuclear reactor as a part of reactor upper internals. Tests were performed by simulating all pertinent prototype conditions achievable in a laboratory environment. The test results show that there exists a fluid-elastic instability of the chimney motion which has a distinct lock-in phenomenon with respect to the flow rate. This unstable vibration is associated with the leakage-flow-modulated excitation through the small clearances between the chimney and its supports.

7556 **(DP-MS—83-25) Simulation of natural convection in a rectangular loop using finite elements.** Pepper, D.W.; Hamm, L.L.; Kehoe, A.B. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1984. Contract AC09-76SR00001. 16p. (CONF-840119—2). NTIS, PC A02/MF A01. Order Number DE84003477.

From 5. international symposium on finite element methods in flow problems; Austin, TX, USA (23 Jan 1984).

A two-dimensional finite-element analysis of natural convection in a rectangular loop is presented. A psi-omega formulation of the Boussinesque approximation to the Navier-Stokes equation is solved by the false transient technique. Streamlines and isotherms at $Ra = 10^4$ are shown for three different modes of heating. The results indicate that corner effects should be considered when modeling flow patterns in thermosyphons.

7557 (INIS-mf—8306, pp 313-329) **Production of semi-finished products and pipes for steam reformers and He/He exchangers of a gas generator.** Ziemann, M.; Weber, H. (Mannesmann-Forschungsinstitut G.m.b.H., Duisburg (Germany, F.R.)); Ohrt, E. (Gesellschaft fuer Hochtemperaturreaktor-Technik m.b.H., Bergisch Gladbach (Germany, F.R.)); Huchtemann, B.; Westerfeld, K.J. 1982. (In German). NTIS (US Sales Only), PC A16/MF A01. (CONF-820182—Vol.14).

From Seminar at the Minister for Economics, Trade and Transportation of the land of North Rhine Westphalia; Duesseldorf, F.R. Germany (14 Jan 1982).

The fundamentals for design by rules and design by analysis are elaborated. Open questions - also of a scientific and technical nature - must be defined and answered in this context. It is well known that basic knowledge is still lacking, even for temperatures below 800°C, and further investigations are required. Apart from construction and testing, also studies on materials mechanics are important for safety assurance in metallic components as the seminar has shown. (orig.).

7558 **(NUREG/CR—2462) Capacity of nuclear power plant structures to resist blast loadings.** Kennedy, R.P.; Blejwas, T.E.; Bennett, D.E. (Sandia National Labs., Albuquerque, NM (USA)). Sep 1983. Contract AC04-76DP00789. 118p. (SAND—83-1250). NTIS, PC A06/MF A01 - GPO. Order Number DE84004271.

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The capacity of safety-related structures at nuclear power plants to safely absorb impulsive loadings arising from accidental explosions is estimated. These safety-related reinforced concrete structures and structural components were assumed to meet the regulatory criteria for seismic and tornado loads which are based on allowing only elastic response. Blast waves from the detonation of both solid explosives and fuel-air mixtures were included in the analysis. Since the expected frequency of occurrence of large, nearby explosions is generally very low, and since the forcing function from a blast loading is characterized by a single impulse, allowing only elastic response is very conservative. In this report, dynamic responses for both elastic and elastic-plastic behavior of the most vulnerable structural components were considered. The principal results are presented as the minimum allowable distance versus weight of explosive for plants sited in the various tornado intensity regions in the United States. More detailed results cover blast capacity as a function of the amount of steel reinforcement. 16 references, 19 figures, 37 tables.

7559 **(NUREG/CR—3081) Review of the Crystal River Nuclear Generating Station Unit No. 3, emergency feedwater system reliability analysis.** Youngblood, R.; Papazoglou, I.A. (Brookhaven National Lab., Upton, NY (USA)). Oct 1983. Contract AC02-76CH00016. 45p. (BNL-NUREG—51626). NTIS, PC A03/MF A01 - GPO $3.75. Order Number DE84004223.

The purposes of this report are to review the Emergency Feedwater System Upgrade Reliability Analysis for the Crystal River Nuclear Generating Station Unit No. 3, and to provide an independent evaluation of the Emergency Feedwater System reliability. This report presents estimates of the probability that the Emergency Feedwater System will be unavailable given each of three different initiators: (1) loss of main feedwater with offsite power available, (2) loss of offsite power, (3) loss of all 4160 VAC power. The scope, methodology, and failure data are prescribed by NUREG-0611, Appendix III. 11 references, 5 tables.

7560 **(NUREG/CR—3482) Analysis of δ-ferrite data from production stainless steel pipe welds.** Hebble, T.L.; Canonico, D.A.; Edmonds, D.P.; Goodwin, G.M.; Nanstad, R.K. (Oak Ridge National Lab., TN (USA)). Jan 1984. Contract W-7405-ENG-26. 17p. (ORNL—6024). NTIS, PC A02/MF A01 - GPO. Order Number DE84004182.

An American Society of Mechanical Engineers task group on stainless steel weld materials was organized to determine the need for ferrite measurements of production welds required by the US Nuclear Regulatory Commission Regulatory Guide 1.31 (Rev. 1). The task group studied paired ferrite measurements [i.e., calculated and measured ferrite numbers (FNs) for the material qualifications versus measured ferrite numbers for corresponding production welds (PWs)]. Our purpose was to compare δ-ferrite content as measured in the filler metal weld qualification pad with that in the resultant PW. Welds made predominantly by three common processes (submerged arc, shielded metal arc, and gas tungsten arc) were included in the study. Weld metals investigated included types 308, 308L, 316, and 316L stainless steel. An initial evaluation of the paired ferrite measurements was made by the task group, and specific conclusions and recommendations were made. We describe the analysis of the data and the conclusions drawn. The data base consisted of a heterogeneous collection of 1449 paired ferrite measurements for several forms and combinations of types 304 and 316 stainless steel pipe qualification pad and production welds. Qualification pad values ranged from 5 to 15 FN, and corresponding values for the PWs ranged from 2.3 to 17.5 FN. Only two PW ferrite numbers were less than 3. For qualification weld ferrite numbers less than 14, the median PW ferrite number was in reasonable agreement. However, the results show a wide scatter. As a result of this analysis and the task group evaluation, we concluded that the requirements of Regulatory Guide 1.31 on the measurement of ferrite in PWs are not necessary and that a ferrite number of 5 in the qualification welds will, in most cases, result in PW ferrite contents greater than 3 FN.

7561 **(ORNL/TM—8845) Experimental stress analysis of four machined 10-in. NPS piping elbows with specified geometric distortions.** Moore, S.E.; Dodge, W.G.; Bolt, S.E. (Oak Ridge National Lab., TN (USA)). Sep 1983. Contract W-7405-ENG-26. 75p. NTIS, PC A04/MF A01. Order Number DE84002410.

Four specially fabricated nominal 10-in. NPS, 90°, long-radius, schedule 40, carbon-steel piping elbows, welded to short lengths of straight pipe, were stress analyzed both experimentally and analytically. One elbow had a circular cross section and a uniform wall thickness, while the other three had either a circular or elliptical cross section with either a uniform or variable wall thickness. The objectives of the tests were primarily to study the influence of out of roundness and wall-thickness variations on the stresses in piping elbows under internal pressure and/or applied moment loadings. Analytical studies were made to isolate the various effects by comparing the experimental data with theoretical baseline solutions. Results of the studies showed that analytical solutions based on no-end-effects (NEE) theory capture the major characteristics of the stress distributions for elbows loaded with pressure and/or in-plane, out-of-plane, or torsional moment loadings. Of the four second-order effects addressed in this study, and effects had the most influence on the stresses, followed in order by out of roundness, wall-thickness variations, and pressure-moment interactions. Of these, the only significant increase in maximum stresses above those predicted by NEE theory was for the case of out of roundness with internal-presure loading.

7562 **(PNL-SA—11396) AE/flaw characterization for nuclear pressure vessels.** Hutton, P.H.; Kurtz, R.J.; Pappas, R.A. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1983. Contract AC06-76RL01830. 10p. (CONF-830811—19). NTIS, PC A02/MF A01. Order Number DE84004839.

From Conference on quantitative NDE; Santa Cruz, CA, USA (7 Aug 1983).

Significant progress has been shown toward resolving major problems in continuous AE monitoring to detect cracking in reactor pressure boundries. Application is considered an attainable goal. Major needs are an expanded data base from application testiong and methodology standardization.

2203 Fuel Elements

REFER ALSO TO CITATION(S) 7654

7563 **(ANSI/ANS—5.4-1982) American National Standard: method for calculating the fractional release of volatile fission products from oxide fuel.** (American Nuclear Society, La Grange Park, IL). 1982. 11p. American Nuclear Society, 555 North Kensington Ave., La Grange Park, IL 60525 $12.00.

This standard provides an analytical method for calculating the release of volatile fission products from oxide fuel pellets during normal reactor operation. When used with nuclide yields, this method will give the so-called gap activity, which is the inventory of volatile fission products that could be available for release from the fuel rod if the cladding were breached. The standard considers high-temperature (up to the melting point) and low-temperature (where temperature-independent processes dominate) releases and distinguishes between short-halflife (halflife less than one year) and long-halflife (halflife greater than one year) nuclides. This standard requires that releases for nuclides of interest be calculated with both the high-temperature and the low-temperature models, and the larger of the two calculated releases is to be taken as the result.

7564 **(CEA-R—5198) High temperature mass spectrometry for thermodynamic study of radioactive materials.** Pattoret, Andre; Philippot, Joseph; Pesme, Olivier. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France)). 1983. 44p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83704156.

Thermodynamic properties and evaporation kinetics are essential data to evaluate the nuclear fuel behaviour under accidental conditions. High temperature mass spectrometry appears as a valuable method to set up a such assessment. However, because of size, complexity and radioactivity of the irradiated samples, important improvements of the classical method are required. The device built in CEN/FAR to overcome these problems is described; performances and possible applications out of the nuclear safety field are presented.

7565 **(DOE/ET/34215—34) Fuel performance improvement program. Semiannual progress report, October 1982-March 1983.** Woods, K.N. (Exxon Nuclear Co., Inc., Richland, WA (USA)). 9 Dec 1983. Contract AC02-76ET34215. 45p. (XN-NF—83-103). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84004101.

Objectives are to develop commercially viable LWR fuel designs which are highly resistant to pellet-cladding interaction (PCI) failures and to demonstrate the satisfactory irradiation performance of the selected designs. The major activity during this reporting period was the nondestructive examination of the segmented rods ramped in September 1982 at the Studsvik R-2 reactor in Sweden. This nondestructive examination program was conducted at the Studsvik site. Other activities included shipment of 11 ramped rodlets from Studsvik to the EIR hot cell facilities in Switzerland for destructive examination; issuance of a topical report summarizing the FPIP ramping results at the Halden Boiling Water Reactor, and development of a fuel assembly reconstitution plan that would allow FPIP fuel rods at the Big Rock Point Reactor (BRPR) to be irradiated to extended burnup.

7566 **(JAERI-M—82-069) Thermal conductivity of oxide fuel under reactor irradiation.** Ohmichi, Toshihiko; Fukushima, Susumu. (Japan Atomic Energy Research Inst., Tokyo). Jun 1982. 18p. (In Japanese). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704157.

Thermal conductivity and its temperature dependence for UO_2 and (U,Pu) O_2 under irradiation in nuclear reactor were reviewed and discussed. Fuel restructuring, oxygen redistribution, build-up of fission products and so forth occured in fuel pellets under irradiation and were taken up as the facters having influence on thermal conductivity. Classifing irradiation roughly into low burn-up and high burn-up, increase or decrease of thermal conductivity due to the phenomenal changes in fuel pellets was speculated.

7567 **(NIIAR—6(521)) System for gamma spectrometric tests of fuel assemblies at the BOR-60 shut-down reactor.** Krajnov, E.V.; Starozhukov, D.I. (Nauchno-Issledovatel'skij Inst. Atomnykh Reaktorov, Dimitrovgrad (USSR)). 1982. 14p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704203.

The automated system intended for aquisition, processing and storage of γ-spectrometric data used for detecting fuel assemblies (FA) with failed fuel elements in the periods of the BOR-60 reactor shutdown, is described. The generalized structural flowsheet of the system is given, the sequence of γ spectra processing and analysis of the results obtained are described. The Li-drifted Ge detector with sensitive volume of 40 cm^3, spectrometric circuit with energy resolution on of 4.5 keV for the 1332 keV line of ^{60}Co and the IN-96 multichannel amplitude analyzer on the base of the Multi-6 computer are employed for measuring γ radiation. The system software ensures preparation for an experiment, on-line γ spectra aquisition and processing, storage of obtained data and service information, off-line experimental data processing. The described system provides to express check of various criteria for failed FA detection and the obtained result representation in a convenient and visual form. It is concluded that automation of the spectrometric data acquisition, storage and processing creates the grounds for the development of new more sensitive and reliable methods for fuel element tightness control.

7568 **(PNL-SA—11381) Inferred residual gaps for IFA-527 rods, compared to PIE measurements.** Lanning, D.D. (Pacific Northwest Lab., Richland, WA (USA)). May 1983. Contract AC06-76RL01830. 12p. (CONF-830563—5). NTIS, PC A02/MF A01. Order Number DE84001907.

From Enlarged halden program group meeting; Loen, Norway (23 May 1983).

The NRC-sponsored assembly IFA-527 contained six xenon-filled rods, each instrumented with fuel thermocouples at each end. Five of the six rods contained stable UO_2 fuel pellets with a fabricated diametral gap size of 230 microns. The rods were unique among instrumented test rods in that their lifetime peak powers were quite low (less than 20 kW/m). The assembly was removed at low exposure (about 2 MWd/kgM) due to pressure seal failures.

The prefailure measured fuel temperatures in the five identical rods were quite similar, and indicated an effective fuel relocation of about 30 to 35 percent of the as-fabricated gap. Examination of rod cross sections in PIE, however, reveals virtually no reduction in the as-fabricated gap. In an attempt to reconcile these two observations, it is demonstrated that pellet eccentricity could account for the inferred effective relocation for these xenon-filled rods. That analysis is extended to an estimate of the proper effective relocation value for low-powered He-filled rods.

2204 Control Systems

7569 **(AAEC/E—560) Measurements of coarse control arm drop characteristics in the materials testing reactor HIFAR.** Marshall, J.; Blevins, R.J. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). Feb 1983. 30p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83704158.

Measurements were made of the angular position/time characteristics of a coarse control arm in the AAEC's materials testing reactor HIFAR, following a trip. The method of measurment is described and the results are presented. It is clear that all of the measured transients may be reasonably fitted by a single differential equation.

7570 **(CEA-CONF—6717) Operating results obtained in a nuclear power plant with a sensor surveillance prototype.** Jacquot, J.P.; Poujol, A.; Beaubatie, J.; Ciaramitaro, W. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Mar 1983. 19p. (CONF-830318—7). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750237.

From 5. power plant dynamics control and testing symposium; Knoxville, TN, USA (21 Mar 1983).

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Surveillance methods have been validated and specific equipment have been built to measure the response time of sensors from a nuclear power plant protection channel. The reason of the choice of this parameter is twofold: the sensor response time is representative of the sensor physical status and is also part of the overall channel response time. Two surveillance methods are used: noise analysis (by AR or PSD modeling), and loop current step response (for resistance thermometer detectors only). The methods were validated on test facilities and on nuclear power plants. Two test equipments were built and tested on plants. Results are represented and conclusions are drawn on the feasibility of such methods for sensor surveillance.

7571 **(CONF-840113—2) Transference of advanced LMFBR control technology to the aerospace power system program.** Chisholm, G.H. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 25p. NTIS, PC A02/MF A01. Order Number DE84003991.

From Symposium on space nuclear power systems; Albuquerque, NM, USA (10 Jan 1984).

Much recent R and D has been devoted to the safety of liquid metal fast breeder reactors (LMFBR's). Part of the resulting technology, especially advanced control systems, appears to be directly transferable to the space nuclear power program. Some of the ideas described herein have been already culminated in successful products that are available for application, e.g. analytical redundancy and fault-tolerant computers. Others, in various stages of R and D, are being developed as elements to support the design goals outlined in the following section, e.g. automated software verification, automated hardware verification, and system validation.

7572 **(CONF-8310143—63) Torsional ultrasonic technique for reactor vessel liquid level measurement.** Dress, W.B. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 13p. NTIS, PC A02/MF A01. Order Number DE84003357.

From 11. NRC water reactor safety research information meeting; Gaithersburg, MD, USA (14 Oct 1983).

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We have undertaken a detailed study of an ultrasonic waveguide employed as a level, density, and temperature sensor. The purpose of this study was to show how such a device might be used in the nuclear power industry to provide reliable level information with a multifunction sensor, thus overcomming several of the errors that led to the accident at Three Mile Island. Some additional work is needed to answer the questions raised by the current study, most noticably the damping effects of flowing water.

7573 **(NUREG/CR—3439-Vol.1) Description of the hardware and software of the power spectral density recognition (PSDREC) continuous on-line reactor surveillance system (California distribution), Volume 1.** Smith, C.M. (Oak Ridge National Lab., TN (USA)). Dec 1983. Contract W-7405-ENG-26. 71p. (ORNL/TM—8862-V1). NTIS, PC A04/MF A01 - GPO. Order Number DE84003867.

This report documents the Power Spectral Density Recognition (PSDREC) Continuous On-Line Reactor Surveillance Program. Volume I of this manual is a description of the major concepts and philosophy of the PSDREC surveillance system. Volume I is of interest to readers who desire to understand how the system operates. Volume II is the appendices which contain detailed information.

2205 Environmental Aspects

REFER ALSO TO CITATION(S) 7622

7574 **(ANSI/ANS—2.13-1979) American National Standard: evaluation of surface-water supplies for nuclear power sites.** (American Nuclear Society, La Grange Park, IL). 1980. 31p. American Nuclear Society, 555 North Kensington Ave., La Grange Park, IL 60525 $32.00.

This standard presents criteria for determining: The availability of a surface water supply for plant operation with respect to both safety and nonsafety-related aspects. Water supply related effects of low flows and low levels on plant operation with respect to both safety and nonsafety-related systems. This standard does not include guidelines to determine the effect of low water due to tsunamis nor the design aspects of structures and systems required to store or deliver water from the source to the plant.

7575 **(GEND—037) Surface activity and radiation field measurements of the TMI-2 reactor building gross decontamination experiment.** McIsaac, C.V. (EG and G Idaho, Inc., Idaho Falls (USA)). Oct 1983. Contract AC07-76ID01570. 122p. NTIS, PC A06/MF A01. Order Number DE84003469.

Surface samples were collected from concrete and metal surfaces within the Three Mile Island Unit 2 Reactor Building on December 15 and 17, 1981 and again on March 25 and 26, 1982. The Reactor Building was decontaminated by hydrolasing during the period between these dates. The collected samples were analyzed for radionuclide concentration at the Idaho National Engineering Laboratory. The sampling equipment and procedures, and the analysis methods and results are discussed. The measured mean surface concentrations of ^{137}Cs and ^{90}Sr on the 305-ft elevation floor before decontamination were, respectively, 3.6 +- 0.9 and 0.17 +- 0.04 $\mu Ci/cm^2$. Their mean concentrations on the 347-ft elevation floor were about the same. On both elevations, walls were found to be considerably less contaminated than floors. The fractions of the core inventories of ^{137}Cs, ^{90}Sr, and ^{129}I deposited on Reactor Building surfaces prior to decontamination were calculated using their mean concentrations on various types of surfaces. The calculated values for these three nuclides are 3.5 +- 0.4 E-4, 2.4 +- 0.8 E-5, and 5.7 +- 0.5 E-4, respectively. The decontamination operations reduced the ^{137}Cs surface activity on the 305- and 347-ft elevations by factors of 20 and 13, respectively. The ^{90}Sr surface activity reduction was the same for both floors, that being a factor of 30. On the whole, decontamination of vertical surfaces was not achieved. Beta and gamma exposure rates that were measured during surface sampling were examined to determine the degree to which they correlated with measured surface activities. The data were fit with power functions of the form y = ax/sup b/. As might be expected, the beta exposure rates showed the best correlation. Of the data sets fit with the power function, the set of December

1981 beta exposure exhibited the least scatter. The coefficient of determination for this set was calculated to be 0.915.

7576 **(INIS-BR—59) Preoperational environmental monitoring of the Angra reactor site. Program and results.** Mendonca, A.H.; Nobrega, A.W.; Mulder, R.U.; Vianna, M.E.C.; Almeida, C.E. de; Winter, M. (Instituto de Radioprotecao e Dosimetria, Rio de Janeiro (Brazil); Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Hauptabteilung Sicherheit). Mar 1983. 107p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE83703949.

The Preoperational Environmental Monitoring Program for the Angra Nuclear power plant site as well as the single and summarized results obtained from this program are presented and discussed in this report. For clarity, a description is given of the Angra site, the program structure and a map of the region showing measurement and sampling locations. Preoperational monitoring was carried out over the period from September 1979 to September 1981. For direct measurements of background radiation levels a solid-state dosimeter network was used and the results were compared to measurements made with ionization chambers. Measurements were performed of natural and artificial radioactivity concentration levels in air, surface water, soil, grass, sea sediments, sea algae and various foodstuffs. Gross alpha and beta activity levels were determined as well as the concentration levels of individual natural radionuclides. The presence of cesium-137 originating from fallout was observed in manioc. Minimum detection limits for fission and activated corrosion products which are of interest during the reactor operational period were defined and determined for the instrumentation and methods used at the Institute of Radioprotection and Dosimetry. These limits have been included in the tables.

7577 (INIS-mf—8584, pp 33-36) **Optimization of detection configuration in measuring activity in nuclear power plant vicinity.** Janecka, S.; Moravek, J. (Vyskumny Ustav Jadrovych Elektrarni, Jaslovske Bohunice (Czechoslovakia)). [nd]. (In Slovak). NTIS (US Sales Only), PC A09/MF A01. (CONF-8105231—).

From Conference on nucleonic instruments and their use in the CSSR; Pribram, Czechoslovakia (18 May 1981).

Published in summary form only.

7578 (INIS-mf—8584, pp 37-39) **Comparison of well-type and annular configurations in monitoring iodine in nuclear power plant stacks by cumulative method.** Moravek, J.; Janecka, S.; Sevecka, S. (Vyskumny Ustav Jadrovych Elektrarni, Jaslovske Bohunice (Czechoslovakia)). [nd]. (In Slovak). NTIS (US Sales Only), PC A09/MF A01. (CONF-8105231—).

From Conference on nucleonic instruments and their use in the CSSR; Pribram, Czechoslovakia (18 May 1981).

Comparing the dynamic characteristics of well-type and annular configurations in the situation of WWER 440 power plant operation showed that both configurations had equal dynamic sensitivity and detection limit. The weight of the annular configuration is about 3 times less (around 150 kg), which allows designing a mobile detector. However, attaining a detection limit comparable to that of the well-type configuration requires the use of an air pump of a capacity of ca. 5 $m^3.h^{-1}$. The well-type configuration is suitable for applications where very low radioiodine concentrations should be measured and where securing high flow is a complex matter and where a high weight (ca. 550 kg) is not a hindrance.

2206 Research, Test, And Experimental Reactors

REFER ALSO TO CITATION(S) 7610, 7618

7579 **(ANSI/ANS—15.1-1982) American National Standard: for the development of technical specifications for research reactors.** (American Nuclear Society, La Grange Park, IL). 1982. 19p. American Nuclear Society, 555 North Kensington Ave., La Grange Park, IL 60525 $20.00.

This standard identifies and establishes the content of technical specifications for research reactors. Areas addressed are Definitions, Safety Limits (SL), Limiting Safety System Settings (LSSS), Limiting Conditions for Operation (LCO), Surveillance Requirements, Design Features, and Administrative Controls. Sufficient detail is incorporated so that applicable specifications can be derived or extracted.

7580 **(BNL—24182-Rev.) HFBR handbook. Revised.** Shapiro, S.; Rorer, D.C.; Kuper, H. (eds.). (Brookhaven National Lab., Upton, NY (USA)). Aug 1983. Contract AC02-76CH00016. 76p. NTIS, PC A05/MF A01. Order Number DE84002574.

This manual is intended primarily to acquaint outside users and new Brookhaven staff members with the research facilities available at the HFBR. In addition to describing the beam lines and major instruments, general information is also provided on the reactor and on services available at the Laboratory.

7581 **(CONF-831012—8) High-density reduced-enrichment fuels for Research and Test Reactors.** Snelgrove, J.L.; Hofman, G.L.; Copeland, G.L. (Argonne National Lab., IL (USA); Oak Ridge National Lab., TN (USA)). 1983. Contract W-31-109-ENG-38. 8p. NTIS, PC A02/MF A01. Order Number DE84003642.

From International symposium on use and development of low and medium flux research reactors; Cambridge, MA, USA (17 Oct 1983).

Development and irradiation testing of high-density fuels have been conducted by the US RERTR Program in order to provide the technical means to reduce the enrichment of fuels for research and test reactors. The traditional aluminum dispersion fuel technology has been extended to include the highest practical loadings of uranium-aluminide (UAl/sub x/, 2.3 MgU/m^3), uranium-oxide (U_3O_8, 3.2 MgU/m^3), and uranium-silicide (U_3Si_2, 5.5 MgU/m^3; U_3Si, 7.0 MgU/m^3) fuels. A third uranium-silicide alloy, U_3SiAl (U + 3.5 wt % Si + 1.5 wt % Al) has been found to perform poorly at high burnup. Testing of miniature fuel plates and full-sized fuel elements is at an advanced stage for the highest loadings of the aluminide and oxide fuels and intermediate loadings of the silicide fuels, and good results have been obtained for low-enriched uranium. The data obtained to date are discussed. 1 reference, 3 figures, 1 table.

7582 **(CONF-831012—9) RERTR program activities related to the development and application of new LEU fuels.** Travelli, A. (Argonne National Lab., IL (USA)). 1983. Contract W-31-109-ENG-38. 11p. NTIS, PC A02/MF A01. Order Number DE84003629.

From International symposium on use and development of low and medium flux research reactors; Cambridge, MA, USA (17 Oct 1983).

The statue of the U.S. Reduced Enrichment Research and Test Reactor (RERTR) Program is reviewed. After a brief outline of RERTR Program objectives and goals, program accomplishments are discussed with emphasis on the development, demonstration and application of new LEU fuels. Most program activities have proceeded as planned, and a combination of two silicide fuels (U_3Si_2-Al and U_3Si-Al) holds excellent promise for achieving the long-term program goals. Current plans and schedules project the uranium density of qualified RERTR fuels for plate-type reactors to grow by approximately 1 g U/cm^3 each year, from the current 1.7 g U/cm^3 to the 7.0 g U/cm^3 which will be reached in late 1988. The technical needs of research and test reactors for HEU exports are also forecasted to undergo a gradual but dramatic decline in the coming years.

7583 **(EGG-SE—6464) Extended life aluminide fuel for university research reactors.** Miller, L.G.; Brown, K.R.; Beeston, J.M.; McGinty, D.M. (EG and G Idaho, Inc., Idaho Falls (USA)). Dec 1983. Contract AC07-76ID01570. 15p. NTIS, PC A02/MF A01. Order Number DE84004233.

A test program is being conducted to determine if the fuel loading and burnup limits for fuel elements in university research reactors can be safely increased beyond the limits presently allowed by reactor licensing restrictions. For the tests, 30 fuel plates were constructed to a maximum fuel loading which could be produced on a commercial basis and to contain a maximum boron content as

used in the INEL Advanced Test Reactor to reduce initial reactor reactivity. A UAl_3 fuel matrix was used to gain higher uranium content. The test program planned for the fuel plates to be irradiated to a 3.3 x 10^{21} fissions/cm^3 average burnup (45% of U-235 for the 50 vol% fuel plate cores), twice the burnup presently allowed in the university reactors. Irradiation performance of the heavy loaded fuel plates has been good at burnups exceeding 2.3 x 10^{21} fissions/cm^3, with one fuel plate reaching a peak burnup of about 3 x 10^{21} fissions/cm^3. Three fuel plates failed, however, during the irradiation, and are undergoing destructive analysis. Corrosion pitting occurred in cladding of both UAl_3 and UAl_3 fuel plates. Some plates appear to be more resistant to corrosion pitting than others. Localized swelling in high fuel loaded plates also is being investigated as a possible failure mode.

7584 **(INIS-mf—8588) Annual report 1981-1982.** (Universities Research Reactor, Risley (UK)). [nd]. 22p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83703957.

The research and teaching programmes of the Universities Research Reactor, Risley, U.K. are reviewed giving outlines of the individual experiments undertaken during 1981-82 and the reactor operation and safety arrangements.

7585 **(LA-UR—83-3404) Los Alamos Omega West Reactor.** Lyle, A.R.; Williams, H.T.; Bunker, M.E. (Los Alamos National Lab., NM (USA)). 1983. Contract W-7405-ENG-36. 8p. (CONF-831012—4). NTIS, PC A02/MF A01. Order Number DE84003849.

From International symposium on use and development of low and medium flux research reactors; Cambridge, MA, USA (17 Oct 1983).

A description is given of the Omega West Reactor and associated experimental facilities, followed by a brief discussion of recent usage, new experiments, and future prospects.

7586 **(LA-UR—83-3405) Computer-automated neutron activation analysis system.** Minor, M.M.; Garcia, S.R. (Los Alamos National Lab., NM (USA)). 1983. Contract W-7405-ENG-36. 7p. (CONF-831012—5). NTIS, PC A02/MF A01. Order Number DE84003825.

From International symposium on use and development of low and medium flux research reactors; Cambridge, MA, USA (17 Oct 1983).

An automated delayed neutron counting and instrumental neutron activation analysis system has been developed at Los Alamos National Laboratory's Omega West Reactor (OWR) to analyze samples for uranium and 31 additional elements with a maximum throughput of 400 samples per day. 5 references.

7587 **(NUREG—1010) Safety evaluation report related to the renewal of the operating license for the Zero-Power Reactor at Cornell University, Docket No. 50-97.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Sep 1983. 72p. NTIS, PC A04/MF A01 - GPO $4.50. Order Number DE83903089.

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This Safety Evaluation Report for the application filed by Cornell University (CU) for a renewal of Operating License R-80 to continue to operate a zero-power reactor (ZPR) has been prepared by the Office of Nuclear Reactor Regulation of the US Nuclear Regulatory Commission. The facility is owned and operated by Cornell University and is located on the Cornell campus in Ithaca, New York. The staff concludes that the ZPR facility can continue to be operated by CU without endangering the health and safety of the public.

7588 **(ORNL/TM—8829) Oak Ridge Research Reactor quarterly report, January, February, and March 1983.** Corbett, B.L.; Lance, E.D. (Oak Ridge National Lab., TN (USA)). Oct 1983. Contract W-7405-ENG-26. 33p. NTIS, PC A03/MF A01. Order Number DE84002255.

The ORR operated at an average power level of 29.7 MW for 36.3% of the time during January, February, and March of 1983. The reactor was shut down on nine occasions, four of which were unscheduled. Reactor downtime needed for refueling and checks was normal. The reactor remained available for operation 36.6% of the time. Maintenance activities, both mechanical and instrument, were essentially routine in nature with the exception of three Mechanical Design Change Memorandums. Implementation of two of the design change memorandums added approximately 1000 hours to the downtime for the quarter. In-service inspection completed during the quarter included visual inspection of the ORR 24-in. primary cooling lines strainer and decay tank.

7589 **(ORNL/TM—8969) Bulk Shielding Facility quarterly report, April, May, and June 1983.** Corbett, B.L.; Lance, E.D. (Oak Ridge National Lab., TN (USA)). Nov 1983. Contract W-7405-ENG-26. 15p. NTIS, PC A02/MF A01. Order Number DE84004120.

The BSR remained shut down the entire quarter for the preparation and fiberglassing of the pool walls and floor. This accounted for 100% of the downtime during April, May, and June. Surveillance tests of the PCA are summarized.

7590 **Inertial-fusion - An energy production option for the future.** Hovingh, J.; Grow, G.R.; Monsler, M.J.; Pitts, J.H. (Lawrence Livermore National Laboratory, Livermore, CA). *Proceedings, Intersociety Energy Conversion Engineering Conference;* 3: 1367-1372(Aug 1982). (CONF-820814—). Contract W-7405-ENG-48.

From 17. Intersociety Energy Conversion Engineering conference; Los Angeles, CA, USA (8 Aug 1982).

The authors discuss the inertial-confinement approach to fusion energy. After explaining the fundamentals of fusion, they describe the state of the art of fusion experiments, emphasizing the results achieved through the use of neodymium-doped glass lasers at Lawrence Livermore National Laboratory and at other laboratories. They highlight recent experimental results confirming theoretical predictions that short-wavelength lasers have excellent energy absorption on fuel pellets. Compressions of deuterium-tritium fuel of over 100 times liquid density have been measured, only a factor of 10 away from the compression required for a commercial reactor. Finally, the authors show how they can exploit the unique characteristics of inertial fusion to design reactor chambers that have a very high power density and a long life, features that they believe will eventually lead to fusion power at a competitive cost.

2207 Plutonium And Isotope Production Reactors

REFER ALSO TO CITATION(S) 7569

2208 Propulsion Reactors

7591 **Space reactors - past, present, and future.** Buden, D.; Angelo, J.A. (Los Alamos National Laboratory, Los Alamos, NM). *Proceedings, Intersociety Energy Conversion Engineering Conference;* 1: 61-68(Aug 1983). (CONF-830812—).

From 18. intersociety energy conversion engineering conference; Orlando, FL, USA (21 Aug 1983).

The successful test flights of the Space Shuttle mark the start of a new era--an era of routine manned access into cislunar space. Human technical development at the start of the next Millenium will be highlighted by the creation of Man's extraterrestrial civilization with off-planet expansion of the human resource base. In the 1990s and beyond, advanced-design nuclear reactors could represent the prime source of both space power and propulsion. Many sophisticated military and civilian space missions of the future will require first kilowatt and then megawatt levels of power. This paper reviews key technology developments that accompanied past US space nuclear power development efforts, describes on-going programs, and then explores reactor technologies that will satisfy megawatt power level needs and beyond.

7592 **Nuclear reactors using fine particulate fuel for primary power in space.** Botts, T.E.; Powell, J.; Usher, J. (Brookhaven National Laboratory, Upton, NY). *Proceedings, Intersociety Energy Conversion Engineering Conference;* 3: 1403-1408(Aug 1982). (CONF-820814—).

From 17. Intersociety Energy Conversion Engineering conference; Los Angeles, CA, USA (8 Aug 1982).

Large future power requirements in space, include power beaming to earth, airplanes, and solar powered satellites in eclipse; industrial processing; and space colonies. The Rotating Bed Nuclear Reactor (RBR) and Fixed Bed Reactor (FBR) are multimegawatt power systems which are light, compact and suited to operation in space. Both are cavity reactors, with an annular fuel region (e.g., a bed of 500 μ HTGR fuel particulates made of UC with ceramic coating) surrounded by a reflector that moderates fast neutrons from the ^{235}U fuel. A porous metal drum holds the fuel. In the RBR, rotation of the drum allows the particulate fuel bed to fluidize as cooling gas passes through. In the FBR, an inner porous carbon drum holds the packed fuel bed, which is not fluidized. The RBR and FBR have many important features for space nuclear power: very high power density; very small size and weight; excellent thermal shock and fatigue resistance; short start/stop times (sec); high gas outlet temperatures (to 3000 K); good neutron economy; low critical mass; and simple, reliable construction.

2209 Reactor Safety

REFER ALSO TO CITATION(S) 7495, 7544, 7587

7593 **(ANSI/ANS—2.8-1981) American National Standard: for determining design basis flooding at power-reactor sites.** (American Nuclear Society, La Grange Park, IL). 17 Feb 1981. 59p. American Nuclear Society, 555 North Kensington Ave., La Grange Park, IL 60525 $35.00.

This document presents a standard to establish design basis flooding for nuclear safety-related features at power reactor sites. Methodology is described to evaluate the flood having virtually no risk of exceedance that may be caused by: precipitation and snowmelt and any resulting dam failures; seismically induced dam failures; surge or seiche and attendant wind-generated wave activity; or a reasonable combination of these events.

7594 **(ANSI/ANS—3.2-1982) American National Standard: administrative controls and quality assurance for the operational phase of nuclear power plants.** (American Nuclear Society, La Grange Park, IL). 9 Aug 1982. 45p. American Nuclear Society, 555 North Kensington Ave., La Grange Park, IL 60525 $35.00.

This standard provides requirements and recommendations for an administrative controls and quality assurance program to help ensure that activities associated with nuclear power plant operation are carried out without undue risk to the health and safety of the public. This standard applies to all activities affecting those functions important to the safety of nuclear power plant structures, systems, and components. Activities included are: design changes, purchasing, fabricating, handling, shipping, storing, cleaning and decontaminating, erecting, installing, inspecting, testing, operating, maintaining, repairing, refueling, modifying and decommissioning.

7595 **(ANSI/ANS—3.7.2-1979) American National Standard: for emergency control centers for nuclear power plants.** (American Nuclear Society, La Grange Park, IL). 24 Apr 1979. 15p. American Nuclear Society, 555 North Kensington Ave., La Grange Park, IL 60525 $16.00.

This standard provides requirements and recommendations for the mission, communications, instrumentation, and equipment associated with each type of control center. The decisional aids, manning requirements, and resources are also enumerated. The communications section covers the normal and alternate means of communications. The decisional aids cover both the accident assessment and the protective action area.

7596 **(ANSI/ANS—4.5-1980) American National Standard: criteria for accident monitoring functions in light-water-cooled reactors.** (American Nuclear Society, La Grange Park, IL). 1980. 17p. American Nuclear Society, 555 North Kensington Avenue, La Grange Park, IL 60525 $20.00.

This standard contains criteria for determining the variables to be monitored by the control room operator of a light water reactor, as required for safety, during the course of an accident including long-term stable shutdown. Also included are criteria for determining the requirements for the equipment used to monitor those variables. The scope of the standard is limited to onsite environment and process monitoring.

7597 **(ANSI/ANS—5.1-1979) American National Standard: for decay heat power in light-water reactors.** (American Nuclear Society, La Grange Park, IL). 29 Aug 1979. 40p. American Nuclear Society, 555 North Kensington Ave., La Grange Park, IL 60525 $25.00.

This standard sets forth values for the decay heat power from fission products and ^{239}U and ^{239}Np following shutdown of light water reactors containing ^{235}U, ^{238}U, and plutonium. The decay heat power from fission products is presented in tables and equivalent analytical representations. Methods are described which account for the reactor operating history, for the effect of neutron capture in fission products, and for assessing the uncertainty in the resultant decay heat power. Equations for the decay heat power from the decay of ^{239}U and ^{239}Np are presented separately. Decay heat power from other actinides and activation products in structural materials and fission power from delayed neutron-induced fission are not included in this standard.

7598 **(ANSI/ANS—51.10-1979) American National Standard: for auxiliary feedwater system for pressurized water reactors.** (American Nuclear Society, La Grange Park, IL). 5 Nov 1979. 27p. American Nuclear Society, 555 North Kensington Ave., La Grange Park, IL 60525 $26.00.

This standard sets forth design bases, performance requirements, design criteria, testing requirements, and interfaces for the safety-related portion of the auxiliary feedwater system (AFS) of pressurized-water reactor plants.

7599 **(ANSI/ANS—52.1-1978) American National Standard: nuclear safety criteria for the design of stationary boiling-water-reactor plants.** (American Nuclear Society, La Grange Park, IL). 16 Mar 1978. 86p. American Nuclear Society, 555 North Kensington Ave., La Grange Park, IL 60525 $45.00.

Purpose of this standard is to establish functional design requirements of safety related structures, systems and components to provide a degree of assurance that boiling water reactor plants will be designed and constructed so that they can be operated without undue risk to the health and safety of the public. It is intended that this objective be accomplished in this standard by defining existing practices which are consistent with the licensing requirements of the NRC and with appropriate industry codes.

7600 **(ANSI/ANS—52.1-1983) American National Standard: nuclear safety criteria for the design of stationary boiling water reactor plants.** (American Nuclear Society, La Grange Park, IL). 1983. 97p. American Nuclear Society, 555 North Kensington Ave., La Grange Park, IL 60525 $40.00.

This standard establishes the nuclear safety criteria and functional design requirements of structures, systems, and components of stationary boiling water reactor (BWR) power plants. Operations, maintenance, and testing requirements are covered only to the extent that they affect design provisions. A methodology is given for classifying all equipment into one of three Safety Classes according to its importance to nuclear safety or into a Non-Nuclear Safety Class. Another methodology is given for identifying and categorizing into one of five Plant Conditions the normal operations and events for which the plant shall be designed. Acceptance criteria are given for each Plant Condition. Specific design requirements are given for each major system in a typical plant. These requirements are related to other, more specific design standards and are intended to amplify the criteria given in the Code of Federal Regulations, Title 10, Energy, Part 50, Licensing of Production and Utilization Facilities, Appendix A, General Design Criteria for Nuclear Power Plants.

7601 **(ANSI/ANS—56.5-1979) American National Standard: for PWR and BWR containment spray system design criteria.** (American Nuclear Society, La Grange Park, IL). 7 Nov 1979. 37p. American Nuclear Society, 555 North Kensington Ave., La Grange Park, IL 60525 $32.00.

This standard provides the design, performance, testing, maintenance, and instrumentation and control requirements for the containment spray system for boiling water and pressurized water reactor stationary electric generating plants. The containment spray system, consisting of a spray subsystem and an additive subsystem, serves to mitigate the consequences of a loss of coolant accident, a PWR feedwater line or a PWR steam line break, by injecting a water spray into the containment atmosphere. The containment spray system may be used to aid safety by performing one or more of the following functions: (1) containment post-accident pressure suppression; (2) containment post-accident heat removal; (3) containment atmosphere post-accident fission product removal; (4) post-accident mixing of containment atmosphere; (5) post-accident containment sump chemistry control.

7602 **(ANSI/ANS—58.2-1980) American National Standard: design basis for protection of light water nuclear power plants against effects of postulated pipe rupture.** (American Nuclear Society, La Grange Park, IL). 31 Dec 1980. 97p. American Nuclear Society, 555 North Kensington Ave., La Grange Park, IL 60525 $55.00.

This standard addresses the design bases for light water reactor, nuclear power plant structures and components essential for the protection of public health and safety from the potential adverse effects of pipe whip, jet impingement, pressurization of compartments outside containment, environmental conditions and flooding associated with a postulated pipe rupture. The design bases for missile protection and the design bases for containment pressurization are not within this standard.

7603 **(ANSI/ANS—58.3-1977) American National Standard: physical protection for systems and components important to safety.** (American Nuclear Society, La Grange Park, IL). 1977. 29p. American Nuclear Society, 555 North Kensington Ave., La Grange Park, IL 60525 $18.00.

The scope of this Standard is to establish the physical protection criteria for systems and components important to safety in nuclear power generating stations that are either light water moderated and cooled (LWR) or graphite moderated and gas cooled (HTGR). This Standard is also generally applicable to other reactor types. Included in the scope of this Standard is an identification of potential hazards to systems and components important to safety, and an acceptable means of insuring the protection of this equipment from the hazards.

7604 **(ANSI/ANS—58.6-1983) American National Standard: criteria for remote shutdown for light water reactors.** (American Nuclear Society, La Grange Park, IL). 17 Feb 1983. 14p. American Nuclear Society, 555 North Kensington Ave., La Grange Park, IL 60525 $19.00.

This standard provides design criteria which require that: (a) specific controls and monitoring equipment shall be provided for achieving and maintaining the plant in a safe shutdown condition; (b) these controls be installed at a location (or locations) that is physically remote from the Control Room and cable spreading areas; (c) simultaneous control from both locations shall be prevented by administrative controls or devices for transfer of control from the Control Room to the remote location(s); and (d) the remote controls be used as defense-in-depth measure in addition to the Control Room shutdown controls and as a minimum shall provide for one complete channel of shutdown equipment.

7605 **(ANSI/ANS—58.11-1983) American National Standard: cooldown criteria for light-water reactors.** (American Nuclear Society, La Grange Park, IL). 10 May 1983. 14p. American Nuclear Society, 555 North Kensington Ave., La Grange Park, IL 60525.

This standard provides design criteria for systems and equipment necessary for the performance of those nuclear safety functions that are required to achieve and maintain a safe shutdown of the reactor to cold shutdown conditions from a hot standby or post accident condition. The following nuclear safety functions are addressed in this standard: reactivity control; reactor coolant system heat removal; reactor coolant system integrity; pressure control; and inventory control. The standard provides criteria for the design of systems used to accomplish these functions.

7606 **(ANSI/ANS—59.3-1977) American National Standard: safety-related control air systems.** (American Nuclear Society, La Grange Park, IL). 20 Jan 1977. 14p. American Nuclear Society, 555 North Kensington Ave., La Grange Park, IL 60525 $13.00.

This Standard applies to those portions of the control air system that furnish air required to support, control, or operate systems or portions of systems that are safety related in nuclear power plants. This Standard relates only to the air supply system(s) for safety-related air operated devices and does not apply to the safety-related air operated device or to air operated actuators for such devices. Objectives of this Standard are to provide minimum system design requirements for equipment, piping, instruments, controls, and wiring that constitute the air supply system; and the system and component testing and maintenance requirements.

7607 **(ANSI/ANS-N—2.3-1979) American National Standard: immediate evacuation signal for use in industrial installations.** (American Nuclear Society, La Grange Park, IL). 13 Sep 1979. 13p. American Nuclear Society, 555 North Kensington Ave., La Grange Park, IL 60525 $16.00.

This standard defines the characteristics of signals for situations requiring prompt evacuation of personnel to prevent serious injury. This standard was developed for use in installations where ionizing radiation exposures might occur, but it may be used for other establishments where immediate evacuation is required.

7608 **(CONF-830609—63) Preliminary analysis of fission gas behavior and fuel response during an LMFBR operational transient.** Liu, Y.Y. (Argonne National Lab., IL (USA)). 1983. Contract W-31-109-ENG-38. 8p. NTIS, PC A02/MF A01. Order Number DE84004038.

From ANS annual meeting; Detroit, MI, USA (12 Jun 1983).

This summary presents results obtained from a preliminary analysis of gas behavior and oxide fuel response during an LMFBR operational transient. The DiMelfi and Deitrich model is extrapolated to operational transient regimes to delineate brittle versus ductile fuel response modes. All pertinent parameters necessary for application of the DiMelfi and Deitrich model were obtained from the LIFE-3 code.

7609 **(CONF-830816—49) Potential effects of the fire protection system sprays at Browns Ferry on fission product transport.** Niemczyk, S.J. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 20p. NTIS, PC A02/MF A01. Order Number DE84003313.

From International meeting on light-water reactor severe accident evaluation; Cambridge, MA, USA (28 Aug 1983).

The fire protection system (FPS) sprays within any nuclear plant are not intended to mitigate radioactive releases to the environment resulting from severe core-damage accidents. However, it has been shown here that during certain postulated severe accident scenarios at the Browns Ferry Nuclear Plant, the functioning of FPS sprays could have a significant impact on the radioactive releases. Thus the effects of those sprays need to be taken into account for realistic estimation of source terms for some accident scenarios. The effects would include direct ones such as cooling of the reactor building atmosphere and scrubbing of radioactivity from it, as well as indirect effects such as an altered likelihood of hydrogen burning and flooding of various safety-related pumps in the reactor building basement. Thus some of the impacts of the sprays would be beneficial with respect to mitigating releases to the environment but some others might not be. The effects of the FPS would be very scenario dependent with a wide range of potential effects often existing for a given accident sequence. Any generalization of the specific results presented here for Browns Ferry to other nuclear plants must be done cautiously, as it appears from a preliminary investigation that the relevant physical and operational characteristics of FPS spray systems differ widely among even otherwise ap-

parently similar plants. Likewise the standby gas treatment systems, which substantially impact the effects of the FPS, differ significantly among plants. More work for both Mark I plants and other plants, BWRs and PWRs alike, is indicated so the potential effects of FPS spray systems during severe accidents can be at least ballparked for more realistic accident analyses.

7610 **(CONF-831047—120) Eutectic-penetration-induced cladding rupture in EBR-II driver fuel elements.** Betten, P.R.; Bottcher, J.H.; Seidel, B.R. (Argonne National Lab., IL (USA)). 1983. Contract W-31-109-ENG-38. 6p. NTIS, PC A02/MF A01. Order Number DE84003577.

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

The purpose of this study was to determine the time to rupture of both irradiated and unirradiated Mk-II fuel elements operating above the eutectic temperature of 715°C.

7611 **(CONF-831047—123) Macroscopic behavior of fast reactor fuel subjected to simulated thermal transients.** Fenske, G.R.; Emerson, J.E.; Savoie, F.E. (Argonne National Lab., IL (USA)). Jun 1983. Contract W-31-109-ENG-38. 6p. NTIS, PC A02/MF A01. Order Number DE84004028.

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

High-speed cinematography has been used to characterize the macroscopic behavior of irradiated and unirradiated fuel subjected to thermal transients prototypical of fast reactor transients. The results demonstrate that as the cladding melts, the fuel can disperse via spallation if the fuel contains in excess of ~ 16 μmoles/gm of fission gas. Once the cladding has melted, the macroscopic behavior (time to failure and dispersive nature) was strongly influenced by the presence of volatile fission products and the heating rate.

7612 **(CONF-8310143—11) BWR severe accident sequence analyses at ORNL - some lessons learned.** Hodge, S.A. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 13p. NTIS, PC A02/MF A01. Order Number DE84001971.

From 11. NRC water reactor safety research information meeting; Gaithersburg, MD, USA (14 Oct 1983).

Boiling water reactor severe accident sequence studies are being carried out using Browns Ferry Unit 1 as the model plant. Four accident studies were completed, resulting in recommendations for improvements in system design, emergency procedures, and operator training. Computer code improvements were an important by-product.

7613 **(CONF-8310143—12) Fission-product transport analysis for the loss of decay-heat-removal accident sequence at Browns Ferry.** Niemczyk, S.J.; Wright, A.L.; Beahm, E.C.; Weber, C.F.; Lorenz, R.A.; Forsberg, V.F.; Ott, L.J. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 3p. NTIS, PC A02/MF A01. Order Number DE84001939.

From 11. NRC water reactor safety research information meeting; Gaithersburg, MD, USA (14 Oct 1983).

7614 **(CONF-8310143—14) Criteria for safety-related operator actions.** Gray, L.H.; Haas, P.M. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 6p. NTIS, PC A02/MF A01. Order Number DE84001973.

From 11. NRC water reactor safety research information meeting; Gaithersburg, MD, USA (14 Oct 1983).

The Safety-Related Operator Actions (SROA) Program was designed to provide information and data for use by NRC in assessing the performance of nuclear power plant (NPP) control room operators in responding to abnormal/emergency events. The primary effort involved collection and assessment of data from simulator training exercises and from historical records of abnormal/emergency events that have occurred in operating plants (field data). These data can be used to develop criteria for acceptability of the use of manual operator action for safety-related functions. Development of criteria for safety-related operator actions are considered.

7615 **(CONF-8310143—18-DRAFT) Overview of experimental support for fission-product transport analyses at Oak Ridge National Laboratory.** Wichner, R.P. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 17p. NTIS, PC A02/MF A01. Order Number DE84002062.

From 11. NRC water reactor safety research information meeting; Gaithersburg, MD, USA (14 Oct 1983).

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The program was designed to determine fission product and aerosol release rates from irradiated fuel under accident conditions, to identify the chemical forms of the released material, and to correlate the results with experimental and specimen conditions with the data from related experiments. These tests of PWR fuel were conducted and fuel specimen and test operating data are presented. The nature and rate of fission product vapor interaction with aerosols were studied. Aerosol deposition rates and transport in the reactor vessel during LWR core-melt accidents were studied. The Nuclear Safety Pilot Plant is dedicated to developing an expanded data base on the behavior of aerosols generated during a severe accident.

7616 **(CONF-8310143—58) Current status of the FASTGRASS/PARAGRASS models for fission product release from LWR fuel during normal and accident conditions.** Rest, J.; Zawadski, S.A.; Piasecka, M. (Argonne National Lab., IL (USA)). Oct 1983. Contract W-31-109-ENG-38. 34p. NTIS, PC A03/MF A01. Order Number DE84003551.

From 11. NRC water reactor safety research information meeting; Gaithersburg, MD, USA (14 Oct 1983).

The theoretical FASTGRASS model for the prediction of the behavior of the gaseous and volatile fission products in nuclear fuels under normal and transient conditions has undergone substantial improvements. The major improvements have been in the atomistic and bubble diffusive flow models, in the models for the behavior of gas bubbles on grain surfaces, and in the models for the behavior of the volatile fission products iodine and cesium. The thoery has received extensive verification over a wide range of fuel operating conditions, and can be regarded as a state-of-the-art model based on our current level of understanding of fission product behavior. PARAGRASS is an extremely efficient, mechanistic computer code with the capability of modeling steady-state and transient fission-product behavior. The models in PARAGRASS are based on the more detailed ones in FASTGRASS. PARAGRASS updates for the FRAPCON (PNL), FRAP-T (INEL), and SCDAP (INEL) codes have recently been completed and implemented. Results from an extensive FASTGRASS verification are presented and discussed for steady-state and transient conditions. In addition, FASTGRASS predictions for fission product release rate constants are compared with those in NUREG-0772. 21 references, 13 figures.

7617 **(CONF-8310143—67) Acoustic leak detection and ultrasonic crack detection.** Kupperman, D.S.; Claytor, T.N.; Groenwald, R. (Argonne National Lab., IL (USA); GARD, Inc., Niles, IL (USA)). Oct 1983. Contract W-31-109-ENG-38. 22p. NTIS, PC A02/MF A01. Order Number DE84004037.

From 11. NRC water reactor safety research information meeting; Gaithersburg, MD, USA (14 Oct 1983).

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A program is under way to assess the effectiveness of current and proposed techniques for acoustic leak detection (ALD) in reactor coolant systems. An ALD facility has been constructed and tests have begun on five laboratory-grown cracks (three fatigue and two thermal-fatigue and two field-induced IGSCC specimens. After ultrasonic testing revealed cracks in the Georgia Power Co. HATCH-1 BWR recirculation header, the utility installed an ALD system. Data from HATCH-1 have given an indication of the background noise level at a BWR recirculation header sweepolet weld. The HATCH leak detection system was tested to determine the sensitivity and dynamic range. Other background data have been acquired at the Watts Bar Nuclear Reactor in Tennessee. An ANL waveguide system, including transducer and electronics, was installed and tested on an accumulator safety injection pipe. The possibility of using ultrasonic wave scattering patterns to discriminate between IGSCCs and geometric reflectors has been explored. Thir-

teen reflectors (field IGSCCs, graphite wool IGSCCs, weld roots, and slits) were examined. Work with cast stainless steel (SS) included sound velocity and attenuation in isotropic and anisotropic cast SS. Reducing anisotropy does not help reduce attenuation in large-grained material. Large artificial flaws (e.g., a 1-cm-deep notch with a 4-cm path) could not be detected in isotropic centrifugally cast SS (1 to 2-mm grains) by longitudinal or shear waves at frequencies of 1 MHz or greater, but could be detected with 0.5-MHz shear waves. 13 figures.

7618 **(CONF-8310176—5) Comparison of safety parameters and transient behavior of a generic 10 MW reactor with HEU and LEU fuels.** Matos, J.E.; Freese, K.E.; Woodruff, W.L. (Argonne National Lab., IL (USA)). 1983. Contract W-31-109-ENG-38. 11p. NTIS, PC A02/MF A01. Order Number DE84003680.

From International meeting on reduced enrichment for research and test reactors; Tokai, Japan (24 Oct 1983).

Key safety parameters are compared for equilibrium cores of the IAEA generic 10 MW reactor with HEU and LEU fuels. These parameters include kinetics parameters, reactivity feedback coefficients, control rod worths, power peaking factors, and shutdown margins. Reactivity insertion and loss-of-flow transients are compared. Results indicate that HEU and LEU cores will behave in a very similar manner.

7619 **(EGG-EA—6467) Initial evaluation of INEL performance during and following the Mackay 1983 earthquake.** Guenzler, R.C. (comp.). (EG and G Idaho, Inc., Idaho Falls (USA)). Nov 1983. Contract AC07-76ID01570. 10p. NTIS, PC A02/MF A01. Order Number DE84004232.

On the morning of October 28, 1983, an earthquake occurred with an epicenter about 15 miles Northwest of Mackay, Idaho. This is a description of the event, shutdown of reactors, inspection of facilities, and a brief discussion of accelerations used in plant designs.

7620 **(EGG-M—21183) PBF OPTRAN experiment results.** Ploger, S.A. (EG and G Idaho, Inc., Idaho Falls (USA)). 1983. Contract AC07-76ID01570. 10p. (CONF-8310143—35). NTIS, PC A02/MF A01. Order Number DE84002213.

From 11. NRC water reactor safety research information meeting; Gaithersburg, MD, USA (14 Oct 1983).

No evidence of PCI-induced fuel rod damage was found after four successive, conservatively severe OPTRAN 1-1 transients. With the qualification that only six, 1-m long rods were tested during OPTRAN 1-1, it now seems that commercial rod failure probabilities would be quite small during a BWR turbine trip without bypass, load rejection without bypass, and other promptly scrammed operational transients. It also appears that standard BWR fuel would tend to resist failure during a severe ATWS. Only one small, incipient PCI crack was detected within the two OPTRAN 1-2 test rods, and oxygen embrittlement from elevated cladding temperatures was insignificant. However, the OPTRAN 1-2 rods did experience cladding phase transformations and large fission gas releases as a consequence of reduced heat transfer to the coolant. This suggests BWR fuel downrating or reloading would be warranted following any commercial ATWS event wherein boiling transitions were induced.

7621 **(GA-A—16508) Accident-condition performance of high-temperature gas-cooled reactor fuels.** Goodin, D.T. (GA Technologies, Inc., San Diego, CA (USA)). Oct 1983. Contract AT03-76ET35300. 121p. NTIS, PC A06/MF A01. Order Number DE84002559.

The performance of TRISO-coated, high-enriched/low-enriched uranium oxide, carbide, and oxycarbide fissile and ThO_2 fertile fuel particles was studied under simulated accident conditions at temperatures up to ~ 2700°C. A total of 2256 fuel particles from 9 different irradiation vehicles with burnups covering the range of design conditions has been tested. The results show that the limiting factor in TRISO-coated fuel performance under severe heating conditions is the high-temperature thermal stability of the SiC coating layer. Total coating failure and high fission product release occur after thermal dissociation of the SiC material takes place. The test data have shown very low failure fractions compared with predictions of previous analytical models and provide the empirical basis for a temperature- and time-dependent TRISO fuel failure model that describes the performance of both fissile and fertile fuel under accident conditions independent of burnup.

7622 **(HEDL-SA—2867-FP) Fuel debris assessment for Three Mile Island Unit 2 (TMI-2) reactor recovery by gamma-ray and neutron dosimetry.** Gold, R.; Roberts, J.H.; McNeece, J.P.; Kaiser, B.J.; Ruddy, F.H.; Preston, C.C.; Ulseth, J.A.; McElroy, W.N. (Hanford Engineering Development Lab., Richland, WA (USA)). 22 Aug 1983. Contract AC06-76FF02170. 17p. (CONF-831175—1). NTIS, PC A02/MF A01. Order Number DE84003950.

From 6. international conference on nondestructive evaluation in the nuclear industry; Zurich, Switzerland (27 Nov 1983).

As a result of the accident on March 28, 1979, fuel debris was dispersed into the primary coolant system of the Three Mile Island Unit 2 (TMI-2) reactor. Location and quantification of fuel debris is essential for TMI-2 recovery. TMI-2 fuel debris assessments can be carried out nondestructively by neutron and gamma-ray dosimetry. Efforts to date have been directed toward fuel debris characterization of the makeup and purification demineralizers, will maintain reactor coolant water purity. Two highly specialized dosimetry methods were applied: solid state track recorder (SSTR) neutron dosimetry and continuous gamma-ray spectrometry. The most recent dosimetry results are reviewed and compared. To reduce the intense background radiation from ^{137}Cs, the Si(Li) detector was surrounded by a 5.5 diameter lead shield 8" shield in length. The spectral data were used to determine the intensity of the 2.18 MeV gamma ray from the fission product ^{144}Ce. Assuming this fission product does not migrate out of the fuel, the quantity of ^{144}Ce is directly related to the quantity of fuel present. Based on the observed source geometry and the measured flux of the ^{144}Ce 2.18 MeV gamma rays, the fuel content of the A demineralizer was calculated to be 1.3 +- 0.6 Kg. The ^{137}Cs content was calculated to be 3400 +- 2500 Curies. Both estimates are as of mid-October, 1982. Due to the intense gamma ray fields present near the demineralizers, SSTR neutron dosimeters had to be placed remotely on stringers from outside the cubicle. Background measurements gave a track density of about 5 tracks/cm^2, whereas baseline measurements in the demineralizer A cubicle was about 10 tracks/cm^2. This difference is due to room return neutrons. Based on this room return response, the SSTR neutron dosimetry result was 1.7 +- 0.6 kg of fuel in demineralizer A. Consequently the results of SSTR neutron dosimetry and continuous gamma-ray spectrometry are in excellent agreement.

7623 **(HEDL-SA—2965-FP) CAPRICORN subchannel code for sodium boiling in LMFBR fuel bundles.** Padilla, A. Jr.; Smith, D.E.; O'Dell, L.D. (Hanford Engineering Development Lab., Richland, WA (USA)). 13 Aug 1983. Contract AC06-76FF02170. 8p. (CONF-831047—88). NTIS, PC A02/MF A01. Order Number DE84001498.

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

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The CAPRICORN computer code analyzes steady-state and transient, single-phase and boiling problems in LMFBR fuel bundles. CAPRICORN uses the same type of subchannel geometry as the COBRA family of codes and solves a similar system of conservation equations for mass, momentum, and energy. However, CAPRICORN uses a different numerical solution method which allows it to handle the full liquid-to-vapor density change for sodium boiling. Results of the initial comparison with data (the W-1 SLSF pipe rupture experiment) are very promising and provide an optimistic basis for proceeding with further development.

7624 **(HEDL-SA—2965-S) Subchannel code for sodium boiling in LMFBR fuel bundles.** Padilla, A. Jr.; Smith, D.E.; O'Dell, L.D. (Hanford Engineering Development Lab., Richland, WA (USA)). 9 Jun 1983. Contract AC06-76FF02170. 7p. (CONF-831047—98). NTIS, PC A02/MF A01. Order Number DE84001681.

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

The CAPRICORN computer code is being developed with the US Fast Reactor Safety program to predict blockage formation and coalability in fuel pin bundles during core disruptive accidents. This code is an extension of the COBRA family of codes. An extension of the ICE solution procedure is used where the mass and energy conservation equations are solved implicitly for pressure and enthalpy in an inner iteration loop. The CAPRICORN code was used to analyze the final and most severe boiling transient of the W-1 SLSF experiment (an in-reactor simulation of a pipe rupture event). Comparison of the CAPRICORN analysis and experimental data was good enough to warrant further improvement and development of the code.

7625 (INIS-mf—8584, pp 22) **Instrumentation for radiation inspection of nuclear power plants in Czechoslovakia.** Raisigl, C.; Vanek, V.; Nechybova, M. (Energoprojekt, Prague (Czechoslovakia)). [nd]. (In Czech). NTIS (US Sales Only), PC A09/MF A01. (CONF-8105231—).

From Conference on nucleonic instruments and their use in the CSSR; Pribram, Czechoslovakia (18 May 1981).

Published in summary form only.

7626 (INIS-mf—8584, pp 29-32) **Use of TESLA instruments in research of radiation safety at VUJE.** Sevecka, S.; Broz, J.; Janecka, S.; Moravek, J. (Vyskumny Ustav Jadrovych Elektrarni, Jaslovske Bohunice (Czechoslovakia)). [nd]. (In Slovak). NTIS (US Sales Only), PC A09/MF A01. (CONF-8105231—).

From Conference on nucleonic instruments and their use in the CSSR; Pribram, Czechoslovakia (18 May 1981).

Brief information is presented on the use of Czechoslovak-made instruments in research of methods and in securing radiation safety in the Jaslovske Bohunice nuclear power plant. Plastic scintillator SAK 15 U 12 in combination with probe NKQ 322 was used for measuring alpha and beta activities of aerosols. Single-channel analyzer NZG 322 was used for evaluation. Well-type scintillation detector SKW-1S-UO4 100 mm in diameter by 100 mm thick with probe NKQ 312 in the lead shielding of scintillation detector NKG 315 were used for monitoring iodine in the stack. Dose ratemeter NRG 302 and detection unit with scintillation detector SKG 1U 05 and probe NKQ 321 were used for measuring dose rates. Single-channel analyzer NZG 201 was used for signal evaluation.

7627 (JAERI-M—82-050) **NSR-77: a computer code for transient analysis of a light water reactor fuel rod.** Ohnishi, Nobuaki; Ishijima, Kiyomi; Saito, Shinzo. (Japan Atomic Energy Research Inst., Tokyo). Jun 1982. 108p. (In Japanese). NTIS (US Sales Only), PC A06/MF A01. Order Number DE83704196.

This report describes computer code NSR-77 written in FORTRAN IV for FACOM-M 200 computer in detail. It has been developed for transient response analysis of a light water reactor fuel rod during an accident such as a reactivityy initiated accident, a loss-of-coolant accident or a power-cooling-mismatch accident. The code consists of subcodes which calculate heat conduction in a fuel rod, gas gap conductance between fuel and cladding, heat transfer from cladding to coolant, fluid hydrodynamics, elastic-plastic fuel and cladding deformation, and material properties, and so on.

7628 (LA-UR—83-3011) **TRAC analysis and support of Oconee-1 PTS studies.** Ireland, J.R. (Los Alamos National Lab., NM (USA)). 1983. Contract W-7405-ENG-36. 15p. (CONF-8310143—10). NTIS, PC A02/MF A01. Order Number DE84001701.

From 11. NRC water reactor safety research information meeting; Gaithersburg, MD, USA (14 Oct 1983).

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This paper describes the overall pressurized thermal shock (PTS) program at Los Alamos with emphasis on TRAC-PF1 calculations of severe overcooling transients for the Oconee-1 pressurized water reactor (PWR). A summary of results for several calculations are presented for the Oconee-1 PWR along with detailed discussions of two of the most severe overcooling transients predicted [main steam-line break and turbine-bypass valve (TBV) failures]. The calculations performed were plant specific in that details of both the primary and secondary sides were modeled in addition to a detailed model of the plant Integrated Control System (ICS). For the Oconee-1 main steam-line break transient, a minimum downcomer fluid temperature of ~ 405 K was predicted. For the TBV transient involving the failure of one bank of TBVs to close after initially opening following reactor and turbine trips, an extrapolated downcomer fluid temperature of ~ 365 K was estimated. The latter temperature is at the nil-ductility temperature (NDT) limit (~ 365 K) for Oconee-1.

7629 (LA-UR—83-3026) **Reactor vital equipment determination techniques.** Bott, T.F.; Thomas, W.S. (Los Alamos National Lab., NM (USA)). 1983. Contract W-7405-ENG-36. 9p. (CONF-8310143—16). NTIS, PC A02/MF A01. Order Number DE84001749.

From 11. NRC water reactor safety research information meeting; Gaithersburg, MD, USA (14 Oct 1983).

The Reactor Vital Equipment Determination Techniques program at the Los Alamos National Laboratory is discussed. The purpose of the program is to provide the Nuclear Regulatory Commission (NRC) with technical support in identifying vital areas at nuclear power plants using a fault-tree technique. A reexamination of some system modeling assumptions is being performed for the Vital Area Analysis Program. A short description of the vital area analysis and supporting research on modeling assumptions is presented. Perceptions of program modifications based on the research are outlined, and the status of high-priority research topics is discussed.

7630 (LA-UR—83-3062) **Three-dimensional thermal-hydraulic calculations using SOLA-PTS.** Daly, B.J.; Torrey, M.D. (Los Alamos National Lab., NM (USA)). 1983. Contract W-7405-ENG-36. 28p. (CONF-8310143—21). NTIS, PC A03/MF A01. Order Number DE84001729.

From 11. NRC water reactor safety research information meeting; Gaithersburg, MD, USA (14 Oct 1983).

The transient, three-dimensional SOLA-PTS code has been used to study the thermal-hydraulic mixing of HPI and ambient fluids in the cold leg and downcomer with application to the pressurized thermal-shock problem. Comparisons of calculated results with 1/5th-scale experimental data are presented and shown to be in good agreement. Also shown are results obtained at full scale for a Combustion Engineering plant (Calvert Cliffs-1) following an assumed main-streamline-break accident.

7631 (LA-UR—83-3116) **PWR shutdown decay-heat removal analyses in support of TAP A-45.** Boyack, B.E.; Henninger, R.J.; Smith, R.C. (Los Alamos National Lab., NM (USA)). 1983. Contract W-7405-ENG-36. 13p. (CONF-8310143—19). NTIS, PC A02/MF A01. Order Number DE84001746.

From 11. NRC water reactor safety research information meeting; Gaithersburg, MD, USA (14 Oct 1983).

The US NRC currently considers the adequacy of shutdown decay heat removal to be an unresolved safety issue (USI A-45). The purpose of Task Action Plan (TAP) A-45 is to evaluate the adequacy of current licensing design requirements, to ensure that nuclear power plants do not pose an unacceptable risk because of failure to remove shutdown decay heat. A major part of TAP A-45 is concerned with the transition from reactor trip to hot shutdown. Also of interest is the transition from hot shutdown to cold shutdown and maintaining cold shutdown conditions. Although a limited number of alternative means for removal of shutdown decay heat from PWRs are being examined by the NRC, this paper focuses on the application of the feed and bleed concept as a diverse alternative method of removing decay heat that does not rely on the use of the steam generators.

7632 (LA-UR—83-3127) **TRAC independent assessment for PWR analysis.** Knight, T.D. (Los Alamos National Lab., NM (USA)). 1983. Contract W-7405-ENG-36. 14p. (CONF-8310143—20). NTIS, PC A02/MF A01. Order Number DE84001744.

From 11. NRC water reactor safety research information meeting; Gaithersburg, MD, USA (14 Oct 1983).

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LANL is developing the Transient Reactor Analysis Code (TRAC) for application to PWRs. Goal was to analyze large-break loss-of-coolant accidents (LOCAs), and the TRAC-P1A and TRAC-PD2 codes primarily addressed the large-break LOCA. The TRAC-PF1 code contained modifications which enhanced the computational speed of the code and improved its application to small-break LOCAs. The TRAC-PF1/MOD1 code added improved steam-generator modeling, a turbine component, and a control system together with modified constitutive relations to model the balance of plant on the secondary side and to extend the applications to non-LOCA transients. During the past year we assessed TRAC-PD2, TRAC-PF1, and TRAC-PF1/MOD1, using LOFT and Semiscale experiments.

7633 **(LBL—15051) Acoustic imaging of vapor bubbles through optically non-transparent media.** Kolbe, W.F.; Turko, B.T.; Leskovar, B. (Lawrence Berkeley Lab., CA (USA)). Oct 1983. Contract AC03-76SF00098. 10p. (CONF-831015—26). NTIS, PC A02/MF A01. Order Number DE84003961.

From Nuclear science symposium; San Francisco, CA, USA (19 Oct 1983).

A preliminary investigation of the feasibility of acoustic imaging of vapor bubbles through optically nontransparent media is described. Measurements are reported showing the echo signals produced by air filled glass spheres of various sizes positioned in an aqueous medium as well as signals produced by actual vapor bubbles within a water filled steel pipe. In addition, the influence of the metallic wall thickness and material on the amplitude of the echo signals is investigated. Finally several examples are given of the imaging of spherical bubbles within metallic pipes using a simulated array of acoustic transducers mounted circumferentially around the pipe. The measurement procedures and a description of the measuring system are also given.

7634 **(NIIAR—18(533)) Calculational model for an accident with large water leak into sodium in a steam generator.** Chernobrovkin, Yu.V.; Kondrat'ev, V.I. (Nauchno-Issledovatel'skij Inst. Atomnykh Reaktorov, Dimitrovgrad (USSR)). 1982. 17p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704162.

A mathematical model describing processes accompanying large water leakage to sodium in sodium-water steam generators is suggested. Algorithm for calculating the compressible liquid pressure and rates in a circuit of arbitrary configuration is described. The model under consideration describes three main processes determining accident run: water or steam outflow through a failed tube, expansion of hydrogen bubble, variation of sodium pressure, rates in the secondary circuit. Basic simplifying preconditions are the following: prompt conversion of all outflowing water to reaction products, isothermal expansion of hydrogen bubble keeping the spherical shape up to the moment of the whole steam generator filling, prompt rupture of the tube. Water and steam outflow lag as well as possibility for reaching at that critical flow rates and sodium compressibility are taken into account. Algorithm for calculating hydrodynamics of a complex circuit is based on its representation in the form of a set of nodes of elementary section joints. Solution for an elementary section is obtained by the method of characteristics. The model suggested is realized in the form of the BESM-6 program, which was used during calculations of hypothetical accidents at the BOR-60 and BN-1600 reactor steam generators. It is concluded that the model under consideration can be used not only for evaluation of maximum loads on equipment but also in calculations of safety systems; for example, a disruptive membrane in sodium.

7635 **(NUREG/CP—0045-Vol.1) Third Japan-US seminar on HTGR safety technology: proceedings. Volume I.** (Brookhaven National Lab., Upton, NY (USA)). 1982. Contract AC02-76CH00016. 308p. (CONF-820650—Vol.1; BNL-NUREG—51674-Vol.1). NTIS, PC A14/MF A01 - GPO. Order Number DE84000514.

From 3. Japan/US HTGR safety technology seminar; Upton, NY, USA (2 Jun 1982).

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Separate abstracts were prepared for the papers presented in the following areas: General Overview; and Accident Delineation and Assessment.

7636 (NUREG/CP—0045-Vol.1, pp 1-22) **USNRC HTGR safety research program overview.** Foulds, R.B. (Nuclear Regulatory Commission, Washington, DC). 1982. NTIS, PC A14/MF A01 - GPO. (CONF-820650—Vol.1; BNL-NUREG—51674-Vol.1).

From 3. Japan/US HTGR safety technology seminar; Upton, NY, USA (2 Jun 1982).

An overview is given of current activities and planned research efforts of the US Nuclear Regulatory Commission (NRC) HTGR Safety Program. On-going research at Brookhaven National Laboratory, Oak Ridge National Laboratory, Los Alamos National Laboratory, and Pacific Northwest Laboratory are outlined. Tables include: HTGR Safety Issues, Program Tasks, HTGR Computer Code Library, and Milestones for Long Range Research Plan.

7637 (NUREG/CP—0045-Vol.1, pp 61-75) **National HTGR safety program.** Davis, D.E.; Kelley, A.P. Jr. (Gas-Cooled Reactor Aassociates, La Jolla, CA). 1982. NTIS, PC A14/MF A01 - GPO. (CONF-820650—Vol.1; BNL-NUREG—51674-Vol.1).

From 3. Japan/US HTGR safety technology seminar; Upton, NY, USA (2 Jun 1982).

This paper presents an overview of the National HTGR Program in the US with emphasis on the safety and licensing strategy being pursued. This strategy centers upon the development of an integrated approach to organizing and classifying the functions needed to produce safe and economical nuclear power production. At the highest level, four plant goals are defined - Normal Operation, Core and Plant Protection, Containment Integrity and Emergency Preparedness. The HTGR features which support the attainment of each goal are described and finally a brief summary is provided of the current status of the principal safety development program supporting the validation of the four plant goals.

7638 (NUREG/CP—0045-Vol.1, pp 92-116) **HTGR accident and risk assessment.** Silady, F.A.; Everline, C.J.; Houghton, W.J. (General Atomic Co., San Diego, CA). 1982. NTIS, PC A14/MF A01 - GPO. (CONF-820650—Vol.1; BNL-NUREG—51674-Vol.1).

From 3. Japan/US HTGR safety technology seminar; Upton, NY, USA (2 Jun 1982).

This paper is a synopsis of the high-temperature gas-cooled reactor probabilistic risk assessments (PRAs) performed by General Atomic Company. Principal topics presented include: HTGR safety assessments, peer interfaces, safety research, process gas explosions, quantitative safety goals, licensing applications of PRA, enhanced safety, investment risk assessments, and PRA design integration.

7639 (NUREG/CP—0045-Vol.1, pp 117-129) **Study on the experimental VHTR safety with analysis for a hypothetical rapid depressurization accident.** Mitake, S.; Suzuki, K.; Ohno, T.; Okada, T. (Japan Atomic Energy Research Inst., Tokyo). 1982. NTIS, PC A14/MF A01 - GPO. (CONF-820650—Vol.1; BNL-NUREG—51674-Vol.1).

From 3. Japan/US HTGR safety technology seminar; Upton, NY, USA (2 Jun 1982).

A hypothetical rapid depressurization accident of the experimental VHTR has been analyzed, including all phenomena in the accident, from its initiating depressurization of the coolant to consequential radiological hazard. Based on reliability analysis of the engineered safety features, all possible sequences, in which the safety systems are in success or in failure, have been investigated with event tree analysis. The result shows the inherent safety characteristics of the reactor and the effectiveness of the engineered safety features. And through the analysis, it has been indicated that further investigations on some phenomena in the accident, e.g., air ingress by natural circulation flow and fission product transport in the plant, will bring forth more reasonable and sufficient safety of the reactor.

7640 (NUREG/CP—0045-Vol.1, pp 130-147) **Some special aspects of HTGR primary loop thermohydraulics during unrestricted core heatup accidents.** Kroeger, P.G.; Hsu, C.J.; Colman, J. (Brookhaven National Lab., Upton, NY). 1982. NTIS, PC A14/MF A01 - GPO. (CONF-820650—Vol.1; BNL-NUREG—51674-Vol.1).

From 3. Japan/US HTGR safety technology seminar; Upton, NY, USA (2 Jun 1982).

During the initial hours of a hypothetical unrestricted core heatup accident, natural circulation flows between relatively hotter and cooler regions of the core provide a large part of the main remaining flow. It is pointed out that these flows are very weak and are strongly dependent on second order effects. Their analysis by the currently used codes, therefore, cannot be accurate. However, initial results from some idealized transient simulations indicate that an accurate knowledge of these weak natural circulation flows may not be required.

7641 (NUREG/CP—0045-Vol.1, pp 148-157) **Control rod ejection analysis during a depressurization accident and the development of a rod-ejection-preventing device.** Mitake, S. (Japan Atomic Energy Research Inst., Tokyo); Itoh, K.; Fukushima, H.; Inoue, T. 1982. NTIS, PC A14/MF A01 - GPO. (CONF-820650—Vol.1; BNL-NUREG—51674-Vol.1).

From 3. Japan/US HTGR safety technology seminar; Upton, NY, USA (2 Jun 1982).

The control rods used for the experimental VHTR are suspended in the core by means of flexible steel cables and it is conceivable that an accidental rod ejection could occur due to a depressurization accident. The computer code AFLADE was developed in order to analyze the possibility of accidental rod ejection, and several studies were performed. The parametric study results showed that the adopted design condition for the VHTR core will not cause a rod ejection accident. In parallel with these accident analyses, a rod-ejection-preventing device was developed in preparation for a hypothetical accident, and its function was verified by the component tests.

7642 (NUREG/CP—0045-Vol.1, pp 158-172) **HTGR severe accident sequence analysis.** Harrington, R.M.; Ball, S.J.; Kornegay, F.C. (Oak Ridge National Lab., TN). 1982. NTIS, PC A14/MF A01 - GPO. (CONF-820650—Vol.1; BNL-NUREG—51674-Vol.1).

From 3. Japan/US HTGR safety technology seminar; Upton, NY, USA (2 Jun 1982).

Thermal-hydraulic, fission product transport, and atmospheric dispersion calculations are presented for hypothetical severe accident release paths at the Fort St. Vrain high temperature gas cooled reactor. Off-site radiation exposures are calculated for assumed releases of 100% of the 24 hour post-shutdown core xenon and krypton inventory and 5.5% of the iodine inventory. The results show conditions under which dose avoidance measures would be desirable and demonstrate the importance of specific release characteristics such as effective release height.

7643 (NUREG/CP—0045-Vol.1, pp 215-230) **Safety and licensing analyses for the Fort St. Vrain HTGR.** Ball, S.J.; Conklin, J.C.; Harrington, R.M.; Cleveland, J.C.; Clapp, N.E. Jr. (Oak Ridge National Lab., TN). 1982. NTIS, PC A14/MF A01 - GPO. (CONF-820650—Vol.1; BNL-NUREG—51674-Vol.1).

From 3. Japan/US HTGR safety technology seminar; Upton, NY, USA (2 Jun 1982).

The Oak Ridge National Laboratory (ORNL) safety analysis program for the HTGR includes development and verification of system response simulation codes, and applications of these codes to specific Fort St. Vrain reactor licensing problems. Licensing studies addressed the oscillation problems and the concerns about large thermal stresses in the core support blocks during a postulated accident.

7644 (NUREG/CP—0045-Vol.1, pp 289-295) **HTGR safety research concerns at NRC.** Minogue, R.B. (Nuclear Regulatory Commission, Washington, DC). 1982. NTIS, PC A14/MF A01 - GPO. (CONF-820650—Vol.1; BNL-NUREG—51674-Vol.1).

From 3. Japan/US HTGR safety technology seminar; Upton, NY, USA (2 Jun 1982).

A general discussion of HTGR technical and safety-related problems is given. The broad areas of current research programs specific to the Fort St. Vrain reactor and applicable to HTGR technology are summarized.

7645 (NUREG/CR—2000-Vol.2-No.11) **Licensee event report (LER) compilation for month of November 1983.** (Oak Ridge National Lab., TN (USA)). Dec 1983. Contract W-7405-ENG-26. 138p. (ORNL/NSIC—200-Vol.2-No.11). NTIS, PC A07/MF A01 - GPO. Order Number DE84004051.

This monthly report contains Licensee Event Report (LER) operational information that was processed into the LER data file of the Nuclear Safety Information Center (NSIC) during the period. The LER summaries in this report are arranged alphabetically by facility name and then chronologically by event date for each facility. Component, system, keyword, and component vendor indexes follow the summaries.

7646 (NUREG/CR—2970-Vol.4) **Materials Science and Technology Division, light-water-reactor safety research program. Quarterly progress report, October-December 1982.** Shack, W.J.; Rest, J.; Kassner, T.F.; Ayrault, G.; Chopra, O.K.; Chung, H.M.; Kupperman, D.S.; Maiya, P.S.; Nichols, F.A.; Park, J.Y. (Argonne National Lab., IL (USA)). Nov 1983. Contract AC02-76CH00016. 133p. (ANL—82-41-Vol.4). NTIS, PC A07/MF A01. Order Number DE84004549.

The research and development areas covered are Environmentally Assisted Cracking in Light Water Reactors, Transient Fuel Response and Fission Product Release, Clad Properties for Code Verification, and Long-Term Embrittlement of Cast Duplex Stainless Steels in LWR Systems.

7647 (NUREG/CR—3483) **Study of the regulatory position on postulated pipe rupture location criteria: piping reliability project.** Woo, H.H. (Lawrence Livermore National Lab., CA (USA)). Nov 1983. Contract W-7405-ENG-48. 42p. (UCRL—53490). NTIS, PC A03/MF A01 - GPO. Order Number DE84004886.

This report presents the results of studies on the current regulatory position on postulated pipe rupture location criteria and recommends future licensing regulations. The report contains five parts. The first part highlights the current regulatory positions on criteria for postulated pipe rupture locations. The second part reviews data on nuclear piping failures related to the failure locations in the piping systems.The third part presents a probabilistic assessment of three nuclear piping lines under fatigue loadings. The fourth part recommends modifying the criteria and scopes future work. The fifth part, Appendix A, provides the validation results for the stress corrosion cracking model. The failure case chosen for comparison with analytical result is a recirculation line safe-end cracking incident in a boiling water reactor.

7648 (NUREG/CR—3538) **Effect of LOCA simulation procedures on ethylene propylene rubber's mechanical and electrical properties.** Bustard, L.D. (Sandia National Labs., Albuquerque, NM (USA)). Oct 1983. Contract AC04-76DP00789. 169p. (SAND—83-1258). NTIS, PC A08/MF A01 - GPO. Order Number DE84004072.

Electrical and mechanical properties of several commercial ethylene-propylene rubber (EPR) materials, typically used as electrical cable insulation, have been monitored during three simulations of nuclear power plant aging and accident stresses. For one set of cables and separate tensile specimens we did a sequential test. We first performed accelerated thermal aging, then irradiated the samples to the combined aging and LOCA total dose. Finally we applied a steam exposure. For a second and third set of cables and separate tensile specimens we used simultaneous applications of elevated temperature and radiation stresses to preaccident age our specimens. We followed these aging exposures by simultaneous radiation and steam exposures to simulate a LOCA environment. Our measurement parameters during these tests included: dc insulation

resistance, ac leakage current, ultimate tensile strength, ultimate tensile elongation, percentage dimensional changes, and percentage moisture absorption. We present test results for nine EPR materials. The implications of our research results for future cable qualification testing efforts is discussed.

7649 **(SAND—83-1810C) Predictions of displacements and stresses in cracked R/C containment vessels subjected to seismic loads: a nonlinear 3-D finite-element approach.** Conley, C.; White, R.N. (Sandia National Labs., Albuquerque, NM (USA); Cornell Univ., Ithaca, NY (USA). Dept. of Structural Engineering). 1983. Contract AC04-76DP00789. 19p. (CONF-830805—65). NTIS, PC A02/MF A01. Order Number DE84001784.

From 7. international conference on structural mechanics in reactor technology; Chicago, IL, USA (22 Aug 1983).

A three-dimensional finite element analysis computer program was developed. Two of the material models incorporated into the program allow independent specification of the shear moduli and in one of the models, one of the moduli can be specified as nonlinear (bilinear). The purpose was to implement a realistic model for cracked reinforced concrete into analyses of reinforced concrete containment vessels and to determine its effect on containment response. The nonlinear material model was derived from experimental results for reinforced concrete panels subjected to combined in-plane tension and shear. Various assignments of shear moduli were made around the circumference of the vessel in an effort to use the available experimental data in conditions under which it was obtained. The analytical model for the containment was subjected to static loads that are representative of horizontal seismic loading.

7650 **(SAND—83-1868C) Large-scale melt interaction tests.** Chu, T.Y.; Brockmann, J.E.; Gronager, J.E. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 17p. (CONF-8310143—71). NTIS, PC A02/MF A01. Order Number DE84004068.

From 11. NRC water reactor safety research information meeting; Gaithersburg, MD, USA (14 Oct 1983).

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A molten core/material interaction experiment was performed at the Large-Scale Melt Facility (LMF) at Sandia National Laboratories. The experiment involved the release of 230 kg of core melt at 2923 K (2650°C), into a magnesia brick crucible. The facility, the melting technology, and results of the experiment, are described. Preliminary evaluations of the results indicate that magnesia brick can be a suitable material for core ladle construction. A brief description of IRIS, a new method for producing large quantities of melt using internal susceptors buried in a matrix of the melt charge is also presented.

7651 **(SAND—83-1911C) Experimental validation of the CONTAIN code.** Murata, K.K.; Bergeron, K.D.; Tills, J.L. (Sandia National Labs., Albuquerque, NM (USA); Tills (Jack) and Associates, Inc., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 11p. (CONF-8310143—64). NTIS, PC A02/MF A01. Order Number DE84003209.

From 11. NRC water reactor safety research information meeting; Gaithersburg, MD, USA (14 Oct 1983).

Recent results demonstrating the calidity of the CONTAIN code have been reviewed. The results to date from the HDR and the ABCOVE code validation programs confirm the predictive ability of CONTAIN in the crucial areas of thermodynamics, surface heat transfer, intercell flow, and aerosol behavior. The results from a code validation exercise, ABCOVE AB-6, which is currently in progress, are expected to confirm the importance of co-agglomeration and the CONTAIN modeling of its effects.

7652 **(SAND—83-1930) Examination results of the Three Mile Island radiation detector HP-R-212.** Mueller, G.M. (Sandia National Labs., Albuquerque, NM (USA)). Dec 1983. Contract AC04-76DP00789. 45p. NTIS, PC A03/MF A01. Order Number DE84004121.

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Area radiation detector HP-R-212 was removed from the Three Mile Island containment building on November 13, 1981. The detector apparently started to fail during November 1979 and by the first part of December 1979 the detector readings had degraded from 1 R/hr to 20 mR/hr. This report discusses the cause of failure, detector radiation measurement characteristics, and our estimates of the total gamma radiation dose received by the detector electronics.

7653 **LMFBR operational and experimental in-core, local-fault experience, primarily with oxide fuel elements.** Warinner, D.K. (Argonne National Laboratory, Argonne, IL 60439). *Journal of Engineering for Power;* 105: No. 3, 669-678(Jul 1983).

Case-by-case reviews of selective world experience with severe local faults, particularly fuel failure and fuel degradation, are reviewed for two sodium-cooled thermal reactors, several LMFBRs, and LMFBR-fuels experiments. The review summarizes fuel-failure frequency and illustrates the results of the most damaging LMFBR local-fault experiences of the last twenty years, beginning with BR-5, and including DFR, BOR-60, BR2's MFBS-and Mol-loops experiments, Fermi, KNK, Rapsodie, EBR-II, and Treat-D2. Local-fault accommodation is demonstrated and a need to more thoroughly investigate delayed-neutron and gaseous-fission-product signals is highlighted in view of uranate formation, observed blockages, and slow fuel-element failure-propagation.

7654 **Analyses with the FSTATE code; fuel performance in destructive in-pile experiments.** Bauer, T.H.; Meek, C.C. (Argonne National Lab., IL (USA). Reactor Analysis and Safety Div.). *Nuclear Engineering and Design;* 74: No. 2, 259-269(Feb 1983).

Thermal-mechanical analysis of a fuel pin is an essential part of the evaluation of fuel behavior during hypothetical accident transients. The FSTATE code has been developed to provide this required computational ability in situations lacking azimuthal symmetry about the fuel-pin axis by performing 2-dimensional thermal, mechanical, and fission gas release and redistribution computations for a wide range of possible transient conditions. In this paper recent code developments are described and applications are made to in-pile experiments undertaken to study fast reactor fuel under accident conditions. Three accident simulations, including a fast and slow ramp-rate overpower as well as a loss of cooling accident sequence, are used as representative examples, and the interpretation of FSTATE computations relative to experimental observations is made.

7655 **Importance of oxygen in LOCA simulation tests.** Gillen, K.T.; Clough, R.L. (Sandia National Labs., Albuquerque, NM (USA)); Ganouna-Cohen, G. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Surete Nucleaire); Chenion, J. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). ORIS); Delmas, G. (Electricite de France, 77 - Les Renardieres. DER). *Nuclear Engineering and Design;* 74: No. 2, 271-285(Feb 1983).

Experiments were performed to survey the effects on material degradation of both aging conditions and the oxygen concentration during a Loss-of-Coolant Accident (LOCA)-simulation. Changes for a number of commercial materials commonly used as electric cable jackets and insulations in nuclear power plant applications were monitored in terms of weight, mechanical properties, solubility measurements and infrared spectroscopy. For a number of these materials (an EPR insulation, a chloroprene jacket and a PVC jacket), the concentration of oxygen during LOCA simulation was found to be an important parameter. For the first two materials, more degradation occurred when oxygen was present; for PVC, substantially increased swelling occurred as the oxygen concentration was lowered. These results indicate that a realistic LOCA-simulation test should include an overpressure of oxygen gas representative of the postulated oxygen concentration expected during a predicted LOCA. Conditions of accelerated aging exposure prior to the LOCA simulation were also found to have a very substantial influence. In particular, for a number of the materials, lowering the radiation dose rate used for aging led to enhanced degradation after both the aging and the LOCA simulation.

7656 **Nuclear heat source safety study for HTGR process heat plant concept.** Landoni, J.A.; Houghten, W.J. (General Atomic Company, San Diego, CA). *Proceedings, Intersociety Energy Conversion Engineering Conference;* **5**: 2139-2144(Aug 1982). (CONF-820814—). Contract AT03-76SF70046.

From 17. Intersociety Energy Conversion Engineering conference; Los Angeles, CA, USA (8 Aug 1982).

The high-temperature gas-cooled reactor process heat (HTGRPH) supplies heat to a reforming process to produce synthesis gas from methane and steam. An indirect cycle with a secondary helium heat transfer loop between the reactor and reformers is used. A safety question arises due to combustible synthesis gas and methane in the reformer and associated piping and equipment at the reactor site. Postulated accidental releases of combustible gases from the reformer area were analyzed. The important release and travel modes were found with event tree analysis encompassing the initial gas leak (compressor failure and reformer train) to potential fission product release. Risk to the public due to vapor clouds that may explode as they drift toward the nuclear safety related structure and installations, leading to core heatup and eventual fission product release to the environment, was determined. This risk is not significantly greater than those low risks already associated with an HTGR-Steam Cycle plant.

7657 **Plaintiffs, technology, law.** Darmstadt, Germany, F.R.; Institut fuer Angewandte Oekologie (1982). 179p. (In German). Institut fuer Angewandte Oekologie, Darmstadt (Germany, F.R.).

In October 1981 there was a weekend-workshop on the topic of "Plaintiffs, Technology, Law" at Schweinfurt. It was organized by the project group on reactor safety of the Oeko-Institut, Gruppe Darmstadt. This book is based on the lectures held at this meeting. In the appendix the lectures are supplemented by surveys of the actions against some nuclear power plants which however, are not quite complete but which give an insight into the possibilities offered by "legal action" in the argument about nuclear energy. It was the aim of the weekend to improve the cooperation between the plaintiffs, technical experts and legal advisors. This book follows the same intention.

25 ENERGY STORAGE

2502 Compressed Gas

REFER ALSO TO CITATION(S) 7234

2504 Capacitor Banks

REFER ALSO TO CITATION(S) 7326

2509 Batteries

REFER ALSO TO CITATION(S) 8183

7658 **(ANL—83-62) Lithium/iron sulfide batteries for electric-vehicle propulsion and other applications. Progress report, October 1981-September 1982.** (Argonne National Lab., IL (USA)). Sep 1983. Contract W-31-109-ENG-38. 83p. NTIS, PC A05/MF A01. Order Number DE84004193.

This report describes the work done on development of lithium/iron sulfide batteries at Argonne National Laboratory during FY 1982. The work at ANL has been concerned principally with the electrochemical and materials aspects of lithium-alloy negative electrodes and iron sulfide positive electrodes, materials research, cell design studies, and the testing and post-test examinations of cells fabricated by two industrial contractors-Eagle-Picher Industries, Inc. and Gould Inc. Particular emphasis was placed on investigations of alternatives to the present Li-Al and FeS electrodes that would be expected to lead to higher specific energy and power, i.e., investigations concerned with Li-Si, Li-Al-Si, Li-Al-Fe, FeS_2. Development work by the two contractors consisted of cell design improvements to increase lifetime and specific power and the fabrication of cells for testing in contractor laboratories and at ANL. Eagle-Picher has continued to use two layers of BN felt as electrode separators in its cells, whereas Gould has concentrated its efforts on MgO powder separators, which are believed to offer a near-term cost advantage but are in a somewhat less advanced stage of development.

7659 **Solid electrolytes strengthened by metal dispersions.** Lauf, R.J.; Morgan, C.S. (to Dept. of Energy). US Patent 4,393,124. 12 Jul 1983. Filed date 5 Oct 1981. vp.

PAT-APPL-308739.

An improvement in solid electrolytes of advanced secondary batteries of the sodium-sulfur, sodium-halogen, and like combinations is achieved by providing said battery with a cermet electrolyte containing a metal dispersion ranging from 0.1 to 10.0 vol. % of a substantially nonreactive metal selected from the group consisting essentially of Pt, Cr, Fe, Co, Ni, Nb, their alloys, and their physical mixtures in the elemental uncombined state, the remainder of said cermet being an ion-conductive ceramic material.

7660 **Performance of a 10-cell LiA/psi//Metal sulfide battery.** Miller, W.E.; Gay, E.C.; Kilsdonk, D. (Argonne National Laboratory, Argonne, IL). *Proceedings, Intersociety Energy Conversion Engineering Conference;* **2**: 585-590(Aug 1982). (CONF-820814—).

From 17. Intersociety Energy Conversion Engineering conference; Los Angeles, CA, USA (8 Aug 1982).

A 4kWh LiA/psi//FeS battery having a molten salt electrolyte was fabricated by Eagle-Picher Industries under contract to ANL and was tested through 150 deep discharge cycles at ANL. The battery module contained ten series connected cells having theoretical capacities of 394 Ah. When fully charged, the battery gave 340 Ah at a 70-A discharge for a cell specific energy of 90 Wh/kg. Battery discharge was terminated when the weakest cell reached a 0.9-V cutoff and was terminated on bulk charge when the strongest cell reached a 1.55-V cutoff. The battery was fully charged through equalization after about every 8 cycles. Between charge equalizations, the battery capacity loss rate was about 0.75% of the fully charged capacity per cycle. Normal capacity fade rate for individual cells is 0.02-0.03% per cycle. The higher loss rate for the battery resulted from capacity and coulombic efficiency differences among the cells. During the last third of battery life three cells developed internal short circuits by a common failure mode.

29 ENERGY PLANNING AND POLICY

7661 **(DOE/EIA—0205(83/2)) Energy Information Directory.** (National Energy Information Center, Washington, DC (USA)). Dec 1983. 72p. NTIS, PC A04/MF A01 - GPO. Order Number DE84004201.

The National Energy Information Center (NEIC), as part of its mission, provides energy information and referral assistance to federal, state, and local governments, the academic community, business and industrial organizations, and the general public. The two principal functions related to this task are: (1) operating a general access telephone line, and (2) responding to energy-related correspondence addressed to the Energy Information Administration (EIA). To assist the NEIC staff, as well as other Department of Energy (DOE) staff, in directing inquiries to the proper office within DOE or other federal agencies, the Energy Information Directory was developed. This directory is a list of many of the government offices that are involved in energy matters. The offices are classified according to their specialities. For the purposes of this publication, each office has been given an alphanumeric identification symbols instead of page numbers in referring the reader to relevant entries. Most entries provide an abbreviated office address. For the complete address, consult the Index of Building Locations. Following the name and title is the DOE routing symbol which refers to the organization and is a part of the mailing address. Because DOE continually undergoes organizational changes, it is possible for the information contained in this directory to have changed by the time it goes to press. The entries are current as of September 16, 1983.

7662 **(GAO/GGD—83-92) Consolidation of federal assistance resources will enhance the federal-state emergency management effort.** (General Accounting Office, Washington, DC (USA). General Government Div.). 30 Aug 1983. 98p. General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760.

By consolidating the resources of closely related emergency planning and preparedness assistance programs provided to the states into a broader emergency management assistance program, the Federal Emergency Management Agency (FEMA) could promote more effective and coordinated implementation of federal and state objectives. FEMA's current approach of funding closely related emergency management objectives through separate, narrowly defined categorical funding programs spawns a fragmented piecemeal approach to planning and preparedness activities that sometimes fosters duplication and inhibits the coordinated and effective use of program resources needed to achieve federal emergency management objectives. GAO recommends that FEMA continue seeking the legislative and budgetary changes needed to merge the resources of closely related programs into a consolidated assistance program. This, coupled with the adoption of GAO's recommended improvements in FEMA's program oversight, will enable FEMA to hold states accountable for achieving specific federal objectives while giving states greater flexibility in determining how to achieve these objectives.

7663 **(GAO/RCED—83-238) Analysis of gasoline prices in Cattaraugus County, New York.** (General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div.). 22 Sep 1983. 9p. General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760.

The Pricing Committee's study was analyzed to compare available federal information on gasoline prices where New York residents complained of inequitable prices. The analysis showed wide fluctuations in prices in any one geographic area which was ascribed to free market supply and demand. These forces have exerted greater variations since federal price controls on gasoline were removed in January 1981. Comparative US data are summarized. (PSB)

7664 **(NP—3770159) Great Britain - energy economy 1981.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Nov 1982. 37p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83770159.

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This is a short survey of the energy situation of the United Kingdom containing a number of characteristic data. Following some remarks on the country's energy policy, it outlines the developments as to the individual energy sources and power generation. Important data on foreign trade are provided in addition.

7665 **(NP—4770032) Republic of South Africa - energy situation 1981.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Feb 1983. 26p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84770032.

The energy situation of South Africa is reviewed on the basis of some relevant data. Its energy policy is commented on, and developments in electric power generation are described as well as the trends observed for the various energy sources. Figures are given on external trade and the balance of payment.

7666 **(NP—4770033) Philippines - energy situation 1981.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Jan 1983. 17p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84770033.

The energy situation of the Philippines is reviewed on the basis of some relevant data. Its energy policy is commented on, and developments in electric power generation are described as well as the trends observed for the various energy sources. Figures are given on external trade and the balance of payment.

7667 **(NP—4770034) Republic of Korea - energy situation 1981.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Jan 1983. 13p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84770034.

The energy situation of the Republic of Korea is reviewed on the basis of some relevant data. Its energy policy is commented on, and developments in electric power generation are described as well as the trends observed for the various energy sources. Figures are given on external trade.

7668 **(NP—4770035) Malaysia - energy situation 1981.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Feb 1983. 17p. (In German). NTIS (US Sales Only), MF A01. Order Number DE84770035.

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The energy situation of Malaysia is reviewed on the basis of some relevant data. Its energy policy is commented on, and developments in electric power generation are described as well as the trends observed for the various energy sources. Figures are given on external trade and the balance of payment.

7669 **(NP—4770036) Pakistan - energy situation 1981/82.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Dec 1982. 20p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84770036.

The energy situation of Pakistan is reviewed on the basis of some relevant data. Its energy policy is commented on, and developments in electric power generation are described as well as the trends observed for the various energy sources. Information is given on external trade and the balance of payment.

7670 **(NP—4770037) Morocco - energy situation 1981/82.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Jan 1983. 23p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84770037.

The energy situation of Marocco is reviewed on the basis of some relevant data. Its energy policy is commented on, and developments in electric power generation are described as well as the trends observed for the various energy sources. Figures are given on external trade and the balance of payment.

7671 **(NP—4770042) Austria - energy situation 1981.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Feb 1983. 23p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84770042.

The energy situation of Austria is reviewed on the basis of some relevant data. Its energy policy is commented on, and developments in electric power generation are described as well as the trends observed for the various energy sources. Figures are given on external trade and the balance of payment.

7672 **(NP—4770043) Burma - energy situation 1981/82.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Feb 1983. 13p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84770043.

The energy situation of Burma is reviewed on the basis of some relevant data. Its energy policy is commented on, and developments in electric power generation are described as well as the trends observed for the various energy sources. External trade and the balance of payment are discussed.

7673 **(NP—4770044) Tansania - energy situation 1981/82.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Jan 1983. 14p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84770044.

The energy situation of Tanzania is reviewed on the basis of some relevant data. Its national and international energy policy is commented on, and developments in electric power generation are described as well as the trends observed for the various energy sources.

7674 **(NP—4770045) Gabon - energy situation 1981.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Jan 1983. 10p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84770045.

The energy situation of Gabon is reviewed on the basis of some relevant data. Its energy policy is commented on, and developments in the various energy sources are described. Figures are given on external trade and the balance of payment.

7675 **(NP—4770046) Indonesia - energy situation 1981.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Dec 1982. 33p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84770046.

The energy situation of Indonesia is reviewed on the basis of some relevant data. Its energy policy is commented on, and developments in electric power generation are described as well as the trends observed for the various energy sources. Figures are given on external trade and the balance of payment.

7676 **(NP—4770047) Cameroon - energy situation 1981/82.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Dec 1982. 15p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84770047.

The energy situation of Cameroon is reviewed on the basis of some relevant data. Its energy policy is commented on, and developments in electric power generation are described as well as the trends observed for the various energy sources. Figures are given on external trade and the balance of payment.

7677 **(NP—4770048) Venezuela - energy situation 1981.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Jan 1983. 13p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84770048.

The energy situation of Venezuela is reviewed on the basis of some relevant data. Its energy policy is commented on, and developments in electric power generation are described as well as the trends observed for the various energy sources. Figures are given on external trade and the balance of payment.

7678 **(NP—4770049) Oman - energy situation 1981.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Jan 1983. 17p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84770049.

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The energy situation of Oman is reviewed on the basis of some relevant data. Its energy policy is commented on, and developments in electric power generation are described as well as the trends observed for the various energy sources. Figures are given on external trade and the balance of payment.

7679 **(NP—4770050) Japan - energy situation 1982.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Oct 1982. 106p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84770050.

The energy situation of Japan is reviewed in detail on the basis of relevant data. Its national energy policy is commented on, and developments in electric power generation are described as well as the trends observed for the various energy sources. Figures are given on external trade and the balance of payment.

2901 Energy Analysis And Modeling

REFER ALSO TO CITATION(S) 7188, 7213, 7214, 7790

7680 **(EUR—8348-EN) EDSES: community energy bus programme's data base with details on the program library and information exchange.** Joels, R.K.; Genoni, F.; Riva-EDSES: carlesso, S.; Rinaudo, F.; Perrucci, D. (Commission of the European Communities, Ispra (Italy). Joint Research Centre). 1983. 73p. ECIS, 2100 M St., NW, Suite 707, Washington, DC 20037.

This document describes the mechanism for the development and the exploitation of a data base, at present in the Joint Research Centre's Ispra Establishment JRC, called the European Data System for Energy Savings (EDSES) which is the specific tool for the storage and exchange of the defined energy data. The general rules and principles referring to the mechanism of data transfer and data exchange have been accepted by the delegates of the institutes participating in the Energy Bus Programme's Ad Hoc Working Group. The technical aspects relating to the adopted systems for data classification and data aggregation are laid out in the appendices of this document. The different tables, codes, etc., listed therein, have been developed according to the requirements and results of the original computer programs made available by the Canadian Department of Energy, Mines and Resources and the specific requirements of the proposed data base; they constitute the necessary guidelines to initiate the collection and the management of the energy data and are the basis for further development and improvement according to modifications and additional specifications, judged as necessary by the participants.

7681 **(NP—4750120) Energy system study for Scandinavia. Preliminary study.** Nitteberg, J.; Ormhaug, T.; Christensen, S.; Morthorst, P.E.; Erling, AA.; Saros, G.; Tamminen, E. (Institute for Energy Technology, Kjeller (Norway)). Feb 1983. 92p. (In Norwegian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84750120.

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This study is a preparation for a general Scandinavian energy systems analysis. It points out potential advantages in coordinating the energy planning and the development of the energy systems. The systems in the Scandinavian countries are studied out from their particular energy situations comparing their resources, energy forecasts and energy plans. The results are seen in relation to the existing Scandinavian energy cooperation, interscandinavian energy and energy related trade, research and development work. The analysis shows that Scandinavia has rich energy supplies, however, resources are unevenly distributed. Norway has large oil and gas resources and hydroelectric power. Also Denmark has oil and gas resourves which are planned to be exploited before 1990. Sweden and Finland have relatively much hydroelectric power and biomass. The interscandinavian energy commerce is modest compared to the trade in other areas. Scandinavia can therefore become more independent of the rest of the world with respect to energy supply. The report consists of 3 parts, a main report, addendum A which is a collocation of data regarding energy utilization and commerce and addendum B. The latter is a proposed project for 1983-84 based on the main report and addendum A. The proposal suggests to construct a Scandinavian energy supply model based on comparable energy statistics, forecasts for expected energy consumption and total energy supply. It consists of 4 partial projects. It is calculated to last 2 years and cost NOK 7988000. 5 drawings, 71 tables.

7682 **(NP—4900393) Forecasting and Policy Analysis Division. Progress report, January 1-April 30, 1976.** Holloway, M.L. (Texas Governor's Energy Advisory Council, Austin (USA). Forecasting and Policy Analysis Div.). 3 May 1976. 25p. NTIS, PC A02/MF A01. Order Number DE84900393.

Progress is reported on: (1) the design and construction of an energy data base; (2) maintenance of an econometric model; (3) assessment of the state-of-the art from new technologies; (4) the analysis of specific policy proposals and (5) the writing of an energy policy paper. Time frames for task objectives are forecast with history and mission of the organization given. (PSB)

7683 **(RISO-M—2390) Model for treating uncertainties in economic assessments of energy technology.** Nielsen, L.H. (Risoe National Lab., Roskilde (Denmark)). Apr 1983. 46p. (In Danish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84750080.

The report describes a model which integrates uncertainties into the economic assessment of energy technologies (e.g. heat pump heating systems). Most data to the model can be stated as probability distribution, and the model calculates the resulting probability distribution of the economic quantity being considered. This information is supplemented by a sensitivity analysis which indicates the effect on the total uncertainties, originating from the individual data distributions. Data to the model and results from the

model are presented graphically. The present version of the model calculates the present value of the total expenditure related to the use of an energy technology over a given period of time. It is intended to extend the model to calculate an effective energy price, present value of difference projects and internal rate of return on the investment.

7684 **(RISO-R—484) Energy Systems Group annual progress report 1 January - 31 December 1982.** Mackenzie, G.A.; Larsen, H. (eds.). (Risoe National Lab., Roskilde (Denmark)). Jun 1983. 43p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84750082.

The report describes the work of the Energy Systems Group at Risoe National Laboratory during 1982. The activities may be roughly classified as Danish energy planning, development and application of energy-economy models and technical-economic analyses of specific parts of the Danish energy system. A brief description of recently started projects is given and the report concludes with a list of the staff members, including experience and areas of interest within the group.

7685 **Approximate aggregation and error in input-output models.** Gibbons, J.C. (Inst. of Tech., Chicago, IL); Wolsky, A.M.; Tolley, G. *Resources and Energy;* 4: 203-230(1982).

Each industry in an input-output model is an aggregate of related, but not identical, production processes. As a result, the industry's input-output coefficients and demand multipliers are averages over the underlying disaggregated parameters. We provide a method for disaggregating an input-output model to obtain more precise estimates of its demand multipliers. This method is then applied to the problem of estimating the sensitivity of the demand multipliers to aggregation errors in the input-output matrix. We prove a theorem which provides upper bounds on the variances of aggregation errors in the multiplier matrix in terms of the variances of errors in the input-output matrix.

2902 Economics And Sociology

REFER ALSO TO CITATION(S) 7175, 7177, 7179, 7180, 7216, 7683, 7711, 7713, 7791

7686 **(NP—4750112) Integrating forest operations with small-scale industrial activities - including energy conversion. Case studies carried out in Colombia, Gambia, India, Norway, Senegal and Thailand.** Gislerud, O.; Wibestad, K. (Norsk Inst. for Skogforskning, Vollebekk). 1981. 168p. NTIS (US Sales Only), PC A08/MF A01. Order Number DE84750112.

Wood harvested for direct use as fuel accounted for 5-6 % of man's energy consumption. Due to rapidly increasing energy prices, the wood processing industry made greater use of wood residues to meet their energy needs. In many developing countries wood fuels are the only economical source of energy available to a large part of the population. The availability of woodfuels is a question of great concern in many regions and countries. When the drain of wood resources from an area exceeds growth, the result is eventually destruction of the forest. The case study on Thailand is limited to a description of the activities of the Forest Industries Organization, which has for example been successful in establishing an agri-silvicultural program at the village level. The main purposes of the program are better land use, control of shifting cultivation, improved forest utilization, and employment, income, and education for the people. The other five case studies give brief descriptions of socio-economic and energy aspects in the countries covered. In each land the forest and forest industry situation is described and discussed as well as cases of integrated forest and forest industry operations. 76 drawings, 29 tables.

7687 **(NP—4900395) Preliminary analysis of prospective natural gas tax revenues.** Holloway, M.L. (Texas Governor's Energy Advisory Council, Austin (USA). Forecasting and Policy Analysis Div.). 26 Oct 1976. 7p. NTIS, PC A02/MF A01. Order Number DE84900395.

The point in time when Texas tax collections from natural gas are likely to peak and decline is estimated. Factors affecting this time are discussed and shown to drastically affect the rise and fall of state revenues from the natural gas tax source. Conclusions show that generally, the price of natural gas at the well-head will continue to more than offset the decrease in production to yield an increase in tax revenues through 1985, if prices for new gas are allowed to move to the market clearing level or if major price increases are allowed under Federal Power Commission rules. Well-head price controls in the neighborhood of 75 cents per Mcf would reverse the recent trend of increasing revenues. The forecasts given here are based on expected prices in a market clearing situation by 1985 and price changes between 1976 and 1985 were estimated by a smooth path between current prices and those forecast for 1985. Therefore, less reliance should be placed on a particular year estimate than the entire ten year period considered as a whole.

7688 **(PB—83-248492) Political economy of protection in Belgium. Working paper.** Tharakan, P.K.M. (International Bank for Reconstruction and Development, Washington, DC (USA)). [nd]. 28p. (WP—431). NTIS MF A01.

This paper reports the results of the analysis of the causes of protection in Belgium. Tariffs were found to be correlated positively with the total and non-wage value added per person, suggesting that the present structure of the European Community's Common External Tariff supports industries in which Belgium has a comparative advantage. However, industries using scarce natural resources also receive some tariff protection, and non-tariff assistance to industry appears to be skewed toward the more labor intensive products. Government assistance to industry on the whole seems to be favoring sectors that are vulnerable to competition from the developing countries. (Copyright (c) 1980 by The World Bank.)

2903 Environment, Health, And Safety

REFER ALSO TO CITATION(S) 7215, 8522, 8523, 8524, 8525, 8561

7689 **(DOE/ER—0156) Geochemical, hydrological, and biological cycling of energy residual. Research plan.** Wobber, F.J. (USDOE Office of Energy Research, Washington, DC. Office of Health and Environmental Research). Mar 1983. 29p. NTIS, PC A03/MF A01. Order Number DE84004901.

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Proposed research goals and specific research areas designed to provide a base of fundamental scientific information so that the geochemical, hydrological, and biophysical mechanisms that contribute to the transport and long term fate of energy residuals in natural systems can be understood are described. Energy development and production have resulted in a need for advanced scientific information on the geochemical transformations, transport rates, and potential for bioaccumulation of contaminants in subsurface environments. (ACR)

7690 **(PB—83-252817) Valley of opportunity: a history of west-central Colorado. Cultural resources series.** Mehls, S.F. (Bureau of Land Management, Denver, CO (USA)). 1982. 362p. NTIS, PC A16/MF A01.

This document represents the latest history to be written for the western slope of Colorado. The three districts in this region of Colorado now have histories specifically for them. Oil and gas, coal, oil shale and other energy minerals, not to mention rights-of-ways, grazing programs, recreation projects and land-use planning, are all supported by histories such as this.

7691 **Industrial energy use, nonattainment and the Clean Air Act reauthorization.** Grogan, P.J.; Garvey, D.B.; Streets, D.G. (Argonne National Lab., IL). pp 181-183 of 4th Miami international conference on alternative energy sources. Veziroglu, T.N. (ed.). Coral Gables, FL; Univ. of Miami (1982). (CONF-811212—).

From 4. international conference on alternative energy sources; Miami Beach, FL, USA (14 Dec 1981).

2904 Natural Resources

REFER ALSO TO CITATION(S) 7162, 8649

7692 **(AD-A—131827/8) Resource management technology: Los Alamos technical capabilities for emergency management.** Killian, B.G.; Garner, S.D.; Mathews, K.L.; Wilson, M.G.; Planner, H.M. (Los Alamos Scientific Lab., NM (USA)). 18 Jul 1983. 258p. NTIS, PC A12/MF A01.

This report examines FEMA mission requirements in the area of resource and emergency management. It reviews the experience of the Los Alamos National Laboratory in resource management technology consonant with FEMA's mission. This experience is presented in the form of internal appraisal of the following mission areas: Strategic Materials; Natural and Technological Disasters; Communications and Training; and Counterterrorism.

7693 **(NP—3770160) Annual report on the raw materials situation 1980/81.** (Bundesanstalt fuer Geowissenschaften und Rohstoffe, Hannover (Germany, F.R.)). Nov 1981. 25p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83770160.

After some remarks on the general situation a survey is given of the supply standard of the F.R. of Germany with the energy raw materials of petroleum and natural gas, coal and nuclear fuels, the non-metal raw materials and the metal raw materials. Finally the recovery of non-precious metals as well as of iron and steel from used and waste materials in the years 1979 and 1980 and the explorations promoted by the Federal Government are reported.

7694 **(PB—83-252247) Scarcity, recycling and substitution of potentially critical materials used for vehicular emissions control. Final report.** (Charles River Associates, Inc., Boston, MA (USA)). Feb 1982. 234p. (CRA—501). NTIS, PC A11/MF A01.

This report discusses the scarcity, recycling, and substitution of imported platinum-group metals; palladium, rhodium, chromium, manganese, nickle and titanium that will be used for vehicular emissions control in the United States. Issues discussed include; EPA policymaking, projections of materials consumption for motor vehicle emission control, background information on the platinum-group metals, recycling of such metals from catalytic converters and substitutes for them.

2905 Research, Development, Demonstration, And Commercialization

REFER ALSO TO CITATION(S) 7376, 7684, 7689, 7726, 7728, 8522, 8523, 8524, 8525, 9188

7695 **(LA—9753-PR) Physics Division semiannual report, July 1-December 31, 1982.** Trela, W.J. (comp.). (Los Alamos National Lab., NM (USA)). Sep 1983. Contract W-7405-ENG-36. 54p. NTIS, PC A04/MF A01. Order Number DE84003702.

The Physics Division is organized into three major research areas: Fusion Physics, Weapons Physics, and Basic Research. In Fusion Physics, the KrF laser project reached two important milestones: successful testing of a 1-m^2 electron diode for KrF gas excitation and completion of a combined aperture demonstration showing the feasibility of accurate alignment of spherical mirrors. In the CO_2 program, the 5-kJ Helios lasers were used to evaluate many physics issues concerning the use of 10-μm light for inertial fusion and the 30- to 40-kJ Antares laser construction projects is on schedule for completion in October 1983. In Weapons Physics, significant progress was made on developing continuous time-dependent imaging systems using tomographic techniques with 400-ps shuttering capability, fiber-optic Cerenkov detector systems for fast fusion measurements, and iron-doped indium-phosphide detectors with 70-ps impulse response. A proposal to build x-ray beam lines at the National Synchrotron Light Source was approved and we expect funding in 1984. In Basic Physics Research, we have begun new initiatives to study biomagnetism in collaboration with the Life Sciences Division and to develop a neutrino physics program. During this period numerous significant experiments were completed in our nuclear physics, condensed matter physics, and thermal physics programs.

7696 **(NP—4770030) Status report 1982. Geotechnics and deposits. Vol. 2.** (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Projektleitung Energieforschung). [nd]. 729p. (In German). NTIS (US Sales Only), PC A99/MF A01. Order Number DE84770030.

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In this second volume of the report about the status seminar 1982 the status reports of almost 50 research works are presented. The reports are grouped into the sections: Coal deposits and exploration of deposits, in-situ gasification of coal, production-technology of petroleum and natural gas, petroleum deposits-geochemical and isotope-geophysical methods, oil shales, deep drilling technique and cavern technology. Abstracts have been presented for the single reports.

2906 Nuclear Energy

REFER ALSO TO CITATION(S) 7275, 7276, 7494, 7495, 7538, 7657

7697 **(DOE/ET/41107—T1) Educating the public about nuclear power. Final report.** (League of Women Voters Education Fund, Washington, DC (USA)). Sep 1981. Contract FG06-80ET41107;FG01-79IR10271. 35p. NTIS, PC A03/MF A01. Order Number DE84004968.

The report summarizes League of women voters education programs on nuclear power. The nuclear energy education program is broken down into program objectives, NEEP advisory committee, the national conference Nuclear Power: Time for Decision, state League nuclear energy education, the film project entitled The Nuclear Debate: Fiction and Fact, publications, and a summary. The state League project descriptions are given along with an index to state League projects. (GHT)

7698 **(DOE/NE—0050) Report to the Congress on alternative financing of the Clinch River Breeder Reactor Plant Project.** (USDOE Assistant Secretary for Nuclear Energy, Washington, DC. Office of Breeder Technology Projects). Mar 1983. 64p. NTIS, PC A04/MF A01. Order Number DE84004734.

The Utility Task Force report found that there is a wide range of possible alternatives for funding a portion of the CRBRP costs which could reduce Federal outlay requirements and attract significant private sector participation. These alternatives range from off-budget Federal guaranteed project financing, to traditional financing of the market value of the plant. The Task Force report considers the family of concepts that are based on seeking private investment commensurate with the market value of the CRBRP as the most viable alternative funding approach although it may be necessary to augment this concept with others of the discussed alternatives depending on the amount of private funding required.

7699 **(INIS-mf—8280) Nuclear topics.** Lukner, C. (Deutsches Atomforum e.V., Bonn (Germany, F.R.)). Jul 1982. 64p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE83704766.

The pamphlet touches on all aspects of nuclear energy, from the world energy demands and consumption, the energy program of the Federal Government, nuclear power plants in the world, nuclear fusion, nuclear liability up to the nuclear fuel cycle and the shutdown of nuclear power plants.

7700 **(INIS-mf—8587) Nuclear Energy. Power for today and tomorrow.** (UKAEA Headquarters, London). Nov 1982. 23p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83703964.

A brief indication is given of the United Kingdom nuclear power programme including descriptions of the fission process, the Magnox, AGR and PWR type reactors, the recycling process, waste management and decommissioning, safety precautions, the prototype fast reactor at Dounreay, and the JET fusion experiment.

7701 **(NUREG/CR—3501) Effects of delaying the operation of a nuclear power plant.** Hill, L.J.; Rainey, J.A.; Tepel, R.C.; Van Dyke, J.W. (Oak Ridge National Lab., TN (USA)). Dec 1983. Contract W-7405-ENG-26. 53p. (ORNL/TM—8684). NTIS, PC A04/MF A01 - GPO. Order Number DE84004554.

This report documents a study of an actual 24-month nuclear power plant licensing delay. A representative utility was chosen for examination. The research was oriented toward determination of the licensing delay's impact on the utility's operating results, ratepayers, and security issues. The methodology utilized to estimate those impacts involved the recursive interaction of a generation costing program to estimate replacement fuel costs and a financial regulatory model to concomitantly determine the impact on the utility, its ratepayers and security issues. The latter model was executed under six alternate scenarios: (1) no delay in the plant's operation; (2) a 24-month delay; (3) a 24-month delay but further assuming all replacement power was generated by coal-fired plants; (4) a 24-month delay assuming all replacement power from oil-fired plants; (5) no delay but assuming the capital cost of the plant was twice as large; and (6) a 24-month delay with the capital cost of the plant twice as large. Three primary conclusions were made. First, under all scenarios, a 24-month delay in operation of the plant has an adverse impact on the utility's internal generation of funds. Second, although electricity rates are not appreciably affected by the delay, the direction of electricity price changes is contingent on the source of fuel used for replacement power. Finally, a 24-month delay has an adverse impact on the indicators used to evaluate the financial soundness of the utility in all cases under consideration.

7702 **Stationing of nuclear weapons in the Federal Republic of Germany - yesterday and today. The safety dilemma of the Federal Republic of Germany.** Risse-Kappen, T. Frankfurt am Main, Germany, F.R.; Hessische Stiftung Friedens- und Konfliktforschung (1981). 15p. (In German). Fachinformationszentrum Energie, Physik, Mathematik, Karlsruhe (Germany, F.R.).

Contribution to a project, "Ensuring Peace in Europe", of the Catholic Working Group on Peace and Development.

The author tries to compare certain lines of argumentation in the discussion on the 1979 NATO resolution on armament with arguments put forward in the "nuclear armament" debate in the FRG at the end of 1950's and in the 1960's, with the aim of making evident the structural problems of deterrence, of the NATO alliance and of the safety of the Federal Republic of Germany. The fact that major arguments of the current discussion on "backfitting" armaments have appeared in similar form in the "nuclear armament" controversy reveals that in both cases structural questions of military safety policy in the nuclear era have been in discussion and still are. As the specific "safety dilemma" of the Federal Republic of Germany is primarily caused by the East-West conflict structure, the way out of it is to increase step by step the degree of information in the East-West activity relations and to thereby help to reduce uncertainties. This is the specific safety-political relevance of policy of detente and aims control.

7703 **Gefahrenbewertung im nichtnuklearen und nuklearen technischen Sicherheitsrecht. (Risk assessments in nuclear and non-nuclear technical safety legislation).** Bettermann, P. Muenster, Germany, F.R.; Muenster Universitaet (1981). 216p. (In German). Library of Muenster Univ. (Germany, F.R.).

To begin with concepts such as "danger", "degree of danger", and "danger potentials" are being defined as elements of judicial concepts involving risks and hazards that justify police intervention. It is thereby demonstrated that these concepts suffice to assess the danger in its entirety for which technical safety legislation should serve as protection. There exists a system of graduated, adequate judicial reaction that ranges from absolute prohibition to absolute freedom. Bureaucratic exemptions, permissions or prohibitions may be free or limited. Differing danger potentials may be reflected in new administrative issues and conditions of the former: If the existing criteria are used for nuclear technology, a significant deficiency of concrete nuclear safety assessment becomes obvious. This, despite the fact that our legal system defines the handling of nuclear fuels as the by far most dangerous technology. (orig./HSCH).

2908 Waste Heat Utilization

REFER ALSO TO CITATION(S) 7172, 7463, 7464, 7506, 7764, 7781, 7800, 7801, 7802, 7803, 7804, 7805, 7806, 7807, 7808, 7809, 7814, 7815, 7817, 7819

7704 **(NP—3770173) Economical district heat supply of cities from power plants located at long distances by suitable heat transportation and distribution systems.** Luchtman, G. (Technische Hochschule Aachen (Germany, F.R.). Fakultaet fuer Maschinenwesen). 8 Aug 1980. 180p. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE83770173.

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The utilization of available power plants for district heat supply can contribute to reducing the petroleum dependence of the Western industrial countries and to using fuels more economically in general. However, up to now the transportation of heat over longer distances has not been economical yet: heating water transportation in insulated piping systems is, if at all, suitable for few large cities. Another facility is rail transport of heat in containers. A model for describing this discontinuous transportation system as to time is developed. Water and some ammonia compounds which are known from refrigeration can act as heat carriers. The great heat storage capacity of the latter is reduced considerably by the strong swelling of salts in gas absorption; As the investigation with the transportation model shows this leads to uneconomic transportation costs for these heat carriers. If water is used as a heat carrier for this transportation system the costs shall be the lowest possible in comparison with all materials investigated. They are relatively independent of the transportation distance until ca. 100 km for transportation tariffs basing on the actual costs.

2910 Conservation

REFER ALSO TO CITATION(S) 7720, 7759, 7824

7705 **Private sector initiatives in energy conservation.** Rebholz, A.F. (The Prudential Ins. Co. of America). *Energy Technology (Washington, D.C.);* **10**: 11-13(Jun 1983). (CONF-830213—).

From 10. energy technology conference; Washington, DC, USA (28 Feb 1983).

As an example of private sector initiatives in energy conservation, Prudential's energy management program is highlighted. In Phase I specific hours of operation were permitted, temperatures were maintained at a prescribed level, and lighting standards were reduced. In Phase II, inefficient HVAC systems were upgraded, timing switches and energy management computers were installed, solar film was applied to windows, and metering utilities were separated. An energy consumption tracking system called PACE was also instrumented to maintain the achieved objectives by monthly measuring.

7706 **Energy Policy and Conservation Act amendments. US House of Representatives, Ninety-Eighth Congress, First Session, Report No. 98-351.** Washington, DC; Government Printing Office (1983). 15p.

The House Committee on Energy and Commerce reports on the purpose and effects of HR 3244, which eliminates state preemptive authority to establish or enforce standards for energy efficiency in the absence of a federal standard as proscribed in the Energy Policy and Conservation Act of 1976. The need to relieve states of the financial and regulatory burden of seeking exemption became evident during hearings, at which it was learned that 48 states are adversely affected by the 1982, no standard, standard proposal for priority home appliances. The report includes findings from the hearings, a section-by-section analysis of the existing law, recommended changes, and minority views. (DCK)

2920 Supply, Demand, And Forecasting

REFER ALSO TO CITATION(S) 7176, 7230, 7727, 7758

7707 **(DOE/EIA—0202(83/4Q)) Short-term energy outlook.** (USDOE Energy Information Administration, Washington, DC. Office of Energy Markets and End Use). Nov 1983. 46p. NTIS, PC A03/MF A01. Order Number DE84004084.

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Domestic petroleum consumption in 1984 is expected to average 15.9 million barrels per day, a 4.7-percent increase over expected 1983 demand of 15.2 million barrels per day. Petroleum demand in 1984 is expected to show an increase, on an annual basis, for the first time since 1978. Projected demand in 1984 is down slightly, despite a somewhat higher forecast for industrial production. This downward revision primarily reflects weaker petroleum demand in the industrial sector than forecasted previously, but it also reflects a slightly lower real disposal personal income and a slightly higher world oil price. Data for the second and third quarters of 1983 show a stronger and faster economic recovery than previously forecast; as a result, manufacturing activity is now projected to rise by 8 percent between 1982 and 1983 and by an additional 10 percent between 1983 and 1984. Although the assumed world oil price of $29.40 per barrel in 1984 is slightly higher than forecast previously, oil prices are still expected to remain stable at the level (in nominal terms) throughout the forecast period.

2930 Policy, Legislation, And Regulation

REFER ALSO TO CITATION(S) 7168, 7188, 7215, 7375, 7687, 7700, 7706, 7728

7708 **(AD-A—132022/5) Oil and its influence on strategic planning. Master's thesis.** Pierce, T.C. (Naval Postgraduate School, Monterey, CA (USA)). Jun 1983. 189p. NTIS, PC A09/MF A01.

This paper analyzes the continuing threat of a serious oil supply disruption and readiness of the U.S. to cope with such a development. Chapter One examines current perceptions of the likelihood of another oil crisis. It argues that these perceptions are critically flawed by an inadequate conceptual understanding of the nature of vulnerability. Chapter Two traces the U.S. response to the 1973-74 and 1978-79 oil crises and surveys the prospects for a future oil crisis. Chapter Three evaluates the present oil glut in relation to the U.S. long-term programs to reduce oil vulnerability. It examines the effect that a new complacement attitude arising from the appearance of surplus may have on efforts to promote policies to avert a future crisis. Chapter Four examines the different contingencies that the U.S. could possibly face as a result of oil dependence. Chapter Five examines U.S. national goals and the linkage between goals and policy. Chapter Six proposes a strategy of attainment to reduce U.S. vulnerability to future oil disruptions. Such a strategy would address both the short and long-term problems that face American strategic planners concerned with the oil issue.

7709 **(INIS-mf—8228) Accident prevention regulation: Thermal power plants (VBG 2). Valid from April 1, 1980.** (Bundesministerium fuer Arbeit und Sozialordnung, Bonn (Germany, F.R.)). Apr 1980. 13p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83703948.

The regulation applies to the operation of 1. heat generation systems with a power of 40 GJ/h and above which are heated with solid fuels, gaseous fuels, or by nuclear fission or fusion. 2. Pipelines and fittings under pressure, leading hot fluids, which are operated together with the heat generation system. 3. Coal feeding and ash removal systems operated together with the heat generation system.

7710 **(INIS-mf—8279) Guiding principles for energy policy in Schleswig-Holstein.** (Ministerium fuer Wirtschaft und Verkehr des Landes Schleswig-Holstein, Kiel (Germany, F.R.)). Jul 1982. 51p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE83704768.

The principles of energy policy in Schleswig-Holstein set forward in this brochure are neither an energy programme nor a descriptive report on the policy of the day. Rather, they are intended to mark the energy-political frame of action within which the government of the Land will more. At the same time their purpose is to provide a medium-term orientation for politics and the power economy, consumers and producers. They are thus consciously made to contrast with political trends conceiving energy policy first of all as a plan-dependent activity. With these guiding principles the government of the Land consistantly continues an energy policy it has exposed in detail in its answer to the Question submitted by the CDU parliamentary party on December 8, 1980.

7711 **(NP—4900397) Preliminary analysis of changes in Texas state revenues from the imposition of a refinery occupation tax and a reduction in motor fuel taxes.** Holloway, M.L. (Texas Governor's Energy Advisory Council, Austin (USA). Forecasting and Policy Analysis Div.). 5 Oct 1976. 10p. NTIS, PC A02/MF A01. Order Number DE84900397.

Portions are illegible in microfiche products.

This paper analyzes two specific tax change alternatives: (1) a newly structured $.01 per barrel occupation tax on Texas refineries and (2) a $.01 per gallon reduction in the current excise tax on motor fuel. The analysis summarizes the expected annual changes for the period 1977-1985.

7712 **(PB—83-248542) Effect of discount rate and substitute technology on depletion of exhaustible resources. Working paper.** Farzin, Y.H. (International Bank for Reconstruction and Development, Washington, DC (USA)). [nd]. 58p. (WP—516). NTIS MF A01.

This paper analyses the validity of several well established propositions in the theory of exhaustible resources in the presence of substitutes. By carefully modelling the technologies of resource extraction and substitute production, the paper shows that: Despite its widespread acceptance in the literature, the basic proposition that a reduction (an increase) in the rate of discount leads to greater conservation (faster depletion) of an exhaustible resource is not generally valid. (Copyright (c) 1982 by The World Bank.)

7713 **(PB—83-249359) Protectionism in the Netherlands. Working paper.** Koekkoek, K.A.; Kol, J.; Mennes, L.B.M. (International Bank for Reconstruction and Development, Washington, DC (USA)). [nd]. 75p. (WP—493). NTIS MF A01.

This work in progress report is part of an inquiry being undertaken by the World Bank in conjunction with scholars from twelve industrial countries into the penetration of the markets of industrial countries by exports of manufactures from developing countries. The project seeks to establish the shares of industrial country markets held by the developing countries, changes in such shares in the 1970s, and why they vary among industry groups and countries. The aim is to assist developing and industrial countries to improve their policies through a better understanding of trade patterns and protectionist pressures. (Copyright (c) 1981 The World Bank.)

7714 **1982 State of energy.** Lee, B.S. (Inst. of Gas Technology). *Energy Technology (Washington, D.C.);* 9: 6-17(Jun 1982). (CONF-820217—).

From 9. energy technology conference; Washington, DC, USA (16 Feb 1982).

The world energy picture, from the standpoint of the US, looked brighter in 1981. Imports fell 21%, OPEC production dropped, world oil prices slowed down, and substitution of domestically produced energy continued. The major world energy events were the unification of OPEC oil prices in October, the consummation of final agreements for the Yamal Project Siberian gas pipeline, the completion of a natural gas pipeline from Tunis to Italy, and new synthetic fuel plants in New Zealand--all of which are discussed. Major US events centered around the Administration's National Energy Policy Plan. Decontrol of oil lead to record high in oil drilling. Waivers were passed on the ANGTS (Alaskan Natural Gas Transportation System). Coal consumption reached record high, but with worry over acid rain. The nuclear picture is gloomy, and the synthetic fuel target set by the Carter Administration is clearly dead.

2940 Fossil Fuels

REFER ALSO TO CITATION(S) 7148, 7160, 7161, 7168, 7175, 7176, 7177, 7179, 7180, 7181, 7184, 7188, 7213, 7214, 7222, 7228, 7229, 7230

7715 (NEAC—10) Strategies for greater utilization of Australian coal. (National Energy Advisory Committee, Canberra (Australia)). 1980. 55p. Australian Government Publications, Canberra.

The equipment and technology necessary for petroleum product substitution in stationary equipment are to a large extent already available and strategies designed to encourage substitution could greatly assist in reducing the total demand for liquid petroleum fuels, even in the short term. There is considerable scope for use of coal or coal derived energy sources such as gas from coal. The Committee recommends what the aims of an explicit coal policy could be.

2950 Hydrogen And Synthetic Fuels

REFER ALSO TO CITATION(S) 7725

2960 Electric Power

REFER ALSO TO CITATION(S) 7725

7716 (DOE/BP—198) Generating resources supply curves. (Bonneville Power Administration, Portland, OR (USA)). 15 Sep 1983. 52p. NTIS, PC A03/MF A01. Order Number DE84004596.

The findings of this study are summarized as a set of supply curves for the following resources: renewable; geothermal, hydro, industrial cogeneration, solar, stand-alone biomass, and wind. Nonrenewable; coal, combustion turbines, and nuclear. Supply curves for 1985, 1990, 1995, and 2000 are tabulated for each year both the levelized costs (1982 dollars) and the cumulative energy available (average megawatts) are shown. All input parameters required to calculate levelized cost as well as pertinent assumptions for both cost and availability are specified in Section III, Resource Analyses.

7717 (DOE/RG/06667—T2-Exec.Summ.) Powerplant productivity improvements and regulatory incentives. George, A.; Brown, D. (Texas Energy and Natural Resources Advisory Council, Austin (USA); Texas Univ., Austin (USA). Center for Energy Studies). 27 Oct 1980. Contract AC01-78RG06667. 81p. NTIS, PC A05/MF A01. Order Number DE84003670.

Purpose of this study is to examine the benefits to be gained from increased power plant productivity and to validate and demonstrate the use of incentives within the regulatory process to promote the improvement of power plant productivity. System-wide costs savings to be gained from given productivity improvement scenarios are estimated in both the short and long term. Numerous reports and studies indicate that productivity improvements at the power plant level are feasible and cost effective. The efforts of this study widen this focus and relate system-wide productivity improvements with system-wide cost savings. The initial thrust of the regulatory section of this study (Chapters III-IV) is to validate the existence of reasonable incentive procedures which would enable regulatory agencies to better motivate electric utilities to improve productivity on both the power plant and system levels. The voluntary incentive format developed in this study was designed to facilitate a strong link between profit and efficiency which is typically not clear in most regulated market environments.

7718 (DOE/RG/06667—T2Vol.1) Powerplant productivity improvements and regulatory incentives. Volume 1. George, A.; Brown, D. (Texas Energy and Natural Resources Advisory Council, Austin (USA); Texas Univ., Austin (USA). Center for Energy Studies). 27 Oct 1980. Contract AC01-78RG06667. 109p. NTIS, PC A06/MF A01. Order Number DE84003528.

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This volume contains the following appendices: unit performance characteristics for the ERCOT (Electric Reliability Council of Texas) region; short-term savings associated with reductions in outages; powerplant performance data; sample simulation results for the TESCO and PRODCOST programs (base case); modeling tool (Regionalized Electric Model); and increased productivity given the typical regulatory environment and the role of incentives. (DLC)

7719 (DOE/RG/06667—T2Vol.2) Powerplant productivity improvements and regulatory incentives. Volume II. George, A.; Brown, D. (Texas Energy and Natural Resources Advisory Council, Austin (USA); Texas Univ., Austin (USA). Center for Energy Studies). 27 Oct 1980. Contract AC01-78RG06667. 53p. NTIS, PC A04/MF A01. Order Number DE84003669.

Portions are illegible in microfiche products.

Appendices Volume II contain a number of highly rigorous proofs for some of the major assertions made in the text. Basically, these proofs relate to: the inability of rate of return regulation to encourage utilities to select a cost-minimal mix of inputs during periods of rapid growth; the capability of a voluntary incentive plan with design characteristics similar to the general format developed in this study to improve the characteristics of rate of return regulation in that area; and, the effectiveness of the general incentive format in a dynamic as well as a static setting. The primary argument in behalf of the general incentive format is that it clearly offers to rate of return regulation a strong connection between profit and efficiency (which is the primary incentive for cost minimization in a functioning competitive market). The proofs do not cover all the beneficiary aspects of the general incentive format. Those that are not included are intuitive.

7720 (DOE/RG/09065—T1) Arkansas DECRA final report, September 1977-December 31, 1981. Stallcup, M.B. (Arkansas Office of the Attorney General, Little Rock (USA). Div. of Energy Conservation and Rate Advocacy). 1981. Contract FG01-78RG09065. 7p. NTIS, PC A02/MF A01. Order Number DE84001507.

This document reports the major tasks of the Division of Energy Conservation and Rate Advocacy, Little Rock, Arkansas and its accomplishments. A summary is given of how grant funds were spent, and of the impact of federal funding on grantees activities. (DLC)

7721 (DOE/RG/10457—T1) Electric power monitoring system graphic subsystem (EPMSGS) system documentation. (Applied Systems Inst., Inc., Washington, DC (USA)). 1 Oct 1981. Contract AC01-81RG10457. 114p. NTIS MF A01. Order Number DE84004168.

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Purpose of this manual is to provide programmers with the information necessary to understand the Electric Power Monitoring System Graphic Subsystem (EPMSGES), its operating environment and maintenance procedures. The EPMS main system creates two (2) extract files, the daily average usages of electricity for monthly and weekly periods. These files are used as input files for the EPMSGS. The EPMSGS is executed on the IBM 3033 at the Energy Information Administration computer facility at the Forrestal Building in Washington, DC. The system consists of three command lists, a Fortran program and five data files. This system creates a file which will be used with the TELA-GRAF system to produce graphic reports.

7722 (DOE/RG/10457—T2) Electric power monitoring system graphic subsystem: user's manual. (Applied Systems Inst., Inc., Washington, DC (USA)). 1 Oct 1981. Contract AC01-81RG10457. 78p. NTIS MF A01. Order Number DE84004169.

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The Graphic subsystem (EPMSGS) was developed to provide system graphic report capabilities based on data extracted from the EPMS files by Applied Systems Institute, Inc. EPMSGS is designed to operate on the IBM 3033 computer at the Energy Information Administration using Fortran Languages. The material in this document describes how to use EPMSGS.

2980 Consumption And Utilization

REFER ALSO TO CITATION(S) 7213, 7228, 7229, 7716, 7790

7723 Estimation of degree-days and ambient temperature bin data from monthly-average temperatures. Erbs, D.G.; Beckman, W.A.; Klein, S.A. (Solar Energy Lab. Univ. of Wisconsin-Madison, Wisconsin). *ASHRAE (American Society of Heating, Refrigeration and Air-Conditioning Engineers) Journal;* **25**: No. 6, 60-65(Jun 1983).

This chapter offers a method which only needs the monthly average ambient temperature to obtain estimates of daily bin data and the monthly heating or cooling degree-days for any base temperature. A relationship is established between ambient temperature bin data and degree-days. Long-term temperature data for nine US locations is used to develop a relationship for estimating bin data. A relationship for estimating monthly degree-days is derived. Both relationships are compared to data from twelve US locations. Additional correlations are developed to allow the estimation of bin data or degree-days for any hour of the day. It is concluded that if the monthly-average solar radiation is known for the month, bin data and degree-days can be estimated for any hour of the day.

7724 Industrial waste stream utilization to conserve energy. Cranford, B. (U.S. Department of Energy Conservation and Renewable Energy Office of Industrial Programs, 1000 Independence Avenue, SW Washington, DC). *Proceedings, Intersociety Energy Conversion Engineering Conference;* **1**: 450-455(Aug 1982). (CONF-820814—).

From 17. Intersociety Energy Conversion Engineering conference; Los Angeles, CA, USA (8 Aug 1982).

Several R & D projects funded by both private industry and DOE will result in significant energy savings for the country while providing profit for the industrial users. This paper discusses the waste streams, technologies, energy savings, markets, economics and analyses of two successful projects funded by the Office of Industrial Programs, Waste Products Utilization Branch. The first project is the re-refining of used motor and industrial oils. The second is the conversion of waste atactic polypropylene to fuel oil.

2990 Unconventional Sources And Power Generation

REFER ALSO TO CITATION(S) 7348, 7375, 7376, 7414, 7686

7725 (CONF-840201—2) Assessing the economic potential of advanced technologies-approach and energy applications. Lance, J.R.; VanBibber, L.E.; Jones, A.R. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Advanced Energy Systems Div.). 1984. Contract AC02-78ET20608. 31p. NTIS, PC A03/MF A01. Order Number DE84003014.

From ASME energy sources technology conference and exhibition; New Orleans, LA, USA (12 Feb 1984).

An approach for assessing advanced technologies is presented and examples are provided for several energy systems. Potential benefits can be cited for many advanced energy systems and considerable resources are devoted to their development. Achievement of the potential benefits in actual practice requires the packaging of an advanced technology in the form of a product meeting user needs and superior to alternate or conventional technologies. It is the authors' contention that the successful development of an advanced energy technology requires a quantitative economic assessment approach that is a continuous, integral component of the development and product design process. The potential user's estimate of the new technology value relative to conventional or alternate technologies is also necessary for accurate assessments.

7726 (NP—4900383) Preliminary brief on the conversion processes and economics of fermentation and thermal conversion plants relative to Section 1420 of the Food and Agriculture Act of 1977. Report 78-04-01. (Texas Governor's Energy Advisory Council, Austin (USA)). 5 Apr 1978. 11p. NTIS, PC A02/MF A01. Order Number DE84900383.

Portions are illegible in microfiche products.

Plans under consideration for submission to the USDA loan guarantee pilot program for the state of Texas are discussed. Technical options, products, special circumstances, and the economics are described. The 2 options most likely to prove feasible are fermentation and thermal conversion. Crops of interest include sugarcane, sweet sorghum and grain sorghum. (DMC)

7727 (ORNL—5989) Assessment of energy options for Liberia. Final report. (Oak Ridge National Lab., TN (USA)). Nov 1983. Contract W-7405-ENG-26. 101p. NTIS, PC A06/MF A01. Order Number DE84004110.

Under funding from the U.S. Agency for International Development (USAID), the Oak Ridge National Laboratory provided energy planning assistance to the National Energy Committee of the Government of Liberia (GOL), West Africa, during a period of one year ending March 31, 1983. This report outlines the scope of activities of the joint GOL/USAID project and summarizes the major findings by Liberian and U.S. project participants. The study included and examination of current energy use by sector and fuel type, projections of future energy demands, and a preliminary evaluation of a variety of alternative energy resource and technology options for Liberia. The primary finding is that Liberia has significant opportunities for the substitution of indigenous energy resources for imported petroleum. The principal candidates are wood energy and hydroelectric power. The major alternatives for wood are gasification technology for small-scale electric and nonelectric applications (e.g., those under about 25-gigajoule/hour input requirements) and wood-fired steam electric generation for larger scale applications where hydroelectric power is unattractive. For major hydroelectric development the principal candidates are the St. Paul River Proposal and the Mano River Proposal. The Mano River Proposal is the smaller of the two and would meet Monrovia area electrical grid requirements and some iron ore mine demand for about the next two decades. An additional important finding of this study is that the Monrovia Petroleum refinery is highly uneconomical and should be closed and petroleum product imported directly. 25 tables.

7728 Biobusiness world data base. Washington, DC; McGraw-Hill Publications (1983). 212p.

This report covers biotechnology activities worldwide. Included are the status of biotechnology research, scale-up, and commercialization for 19 countries; financial, patent, technical, and regulatory barriers to commercialization; potential products using recombinant DNA technology for the pharmaceutical, chemical, fuel, agricultural, and food processing industries, sale projections to the year 2000; international agreements on marketing, production, and research in biotechnology; and patent activity in biotechnology listed by country. Specific strategies for commercialization in various countries, product priorities of 136 US companies, equipment sales projections to 1992, and proposed US government strategies for protecting and strengthening US biotechnology industry are also included. (CKK)

7729 Flash pyrolysis and hydropyrolysis of biomass. (Brookhaven National Laboratory, Upton, NY). *Proceedings, Intersociety Energy Conversion Engineering Conference;* **1**: 253-258(Aug 1982). (CONF-820814—).

From 17. Intersociety Energy Conversion Engineering conference; Los Angeles, CA, USA (8 Aug 1982).

Process chemistry data on the flash pyrolysis and hydropyrolysis of wood is being obtained in a 1" downflow entrained tubular reactor. The data indicates that at residence times of <1 second, and 900 to 1000°C and 500 psi pressure, the flash hydropyrolysis of wood yields mainly methane and water. As the residence time increases to >3 seconds, the products are methane and CO. Almost complete conversion of the carbon to methane and CO are obtained in these experiments. At lower temperatures, in the order of 800°C, 500 psi and residence times <4 seconds, significant amounts of benzene and ethane are produced. The experimental process chemistry data have been used to design and evaluate two processes in a preliminary manner. One process converts wood to high BTU pipeline gas and the other to methanol and chemical feedstocks consisting of benzene and ethylene. Reasonable plant investments which compare favorably with coal conversion plant estimates are derived.

7730 **Continuous steam hydrolysis of tulip poplar.** Fieber, C.; Colcord, A.R.; Faass, S.; Muzzy, J.D.; Roberts, R.S. (Georgia Inst. of Technology, Atlanta, GA). *Proceedings, Intersociety Energy Conversion Engineering Conference;* 1: 271-277(Aug 1982). (CONF-820814—).

From 17. Intersociety Energy Conversion Engineering conference; Los Angeles, CA, USA (8 Aug 1982).

To produce ethanol from hardwood it is desirable to fractionate the hardwood in order to produce a relatively pure cellulosic pulp for dilute acid hydrolysis. An experimental investigation of continuous steam hydrolysis of tulip poplar wood chips indicates that over 90% of the lignin present can be extracted by 0.1N sodium hydroxide, resulting in a cellulose pulp containing over 90% hexosan. The study was performed using a Stake Technology, Ltd., continuous digester rated at one oven dry ton per hour of wood chips. The yields of hexosans, hexoses, xylan, xylose, lignin, furfural, acetic acid and methanol were determined as a function of residence time and steam pressure in the digester. The information provides a basis for establishing a material and energy balance for a hardwood to ethanol plant.

7731 **Short rotation woody crops as a source of energy.** Ranney, J.W.; Cushman, J.H. (Oak Ridge Nat'l Laboratory, Oak Ridge, Tennessee). *Energy Technology (Washington, D.C.);* 9: 1391-1399(Jun 1982). (CONF-820217—).

From 9. energy technology conference; Washington, DC, USA (16 Feb 1982).

Short rotation intensive culture (SRIC) is a management approach with special advantages for producing wood for energy when land is in short supply. It has as its objective producing the maximum sustainable amount of wood per unit of land each year. The Short Rotation Woody Crops Program (SRWCP) is designed to answer major questions about SRIC. A 125% improvement in productivity can be acheived with genetic selection, disease resistance, weed control, fertilizers, spacing of trees and timing of harvest, and coppice growth. The economics and the risks of SRIC are reviewed. A list of work to be done concludes the study.

30 DIRECT ENERGY CONVERSION

3001 Mhd Generators

REFER ALSO TO CITATION(S) 7173, 7174

7732 **(CONF-840201—4) Fouling of convective heat exchangers in an MHD steam plant.** Chow, L.S.H.; Smyk, E.B.; Johnson, T.R.; Klinger, J.G. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 25p. NTIS, PC A02/MF A01. Order Number DE84003646.

From ASME energy sources technology conference and exhibition; New Orleans, LA, USA (12 Feb 1984).

At Argonne National Laboratory (ANL), the fouling of the convective heat transfer surfaces by seed and coal ash is being studied in order to obtain data for MHD steam plant design. Fouling experiments are being conducted in the Fossil Energy Users Laboratory (FEUL). In these tests, the seed-slag deposition rates and their effects on heat transfer to the convective heat exchanger surfaces and the size distribution of the seed particles are measured. In addition, the characteristics of the seed-slag deposits are studied. In conjunction with the experiments, theoretical models are developed to predict: (1) the deposition rates of seed and ash, (2) the heat transfer rates to the convective heat exchangers, and (3) the size distribution of the seed particles. These models are applied to interpret and extrapolate the test results. The measured data, together with the theoretical models, are essential to the design of the convective sections of an MHD steam plant.

7733 **(INIS-mf—8663, pp 85) MHD electric power generation.** Messerle, H.K. (Sydney Univ. (Australia)). Feb 1983. NTIS (US Sales Only), PC A06/MF A01. (CONF-830237—Absts.).

From 14. AINSE plasma physics conference; Lucas Heights, Australia (7 Feb 1983).

7734 **(INIS-mf—8663, pp 86) Behaviour of multi-electrode linear MHD generators.** Scott, J.D.; Simpson, S.W. (Sydney Univ. (Australia). School of Electrical Engineering). Feb 1983. NTIS (US Sales Only), PC A06/MF A01. (CONF-830237—Absts.).

From 14. AINSE plasma physics conference; Lucas Heights, Australia (7 Feb 1983).

7735 **Effects of cathode slag polarization on MHD generator performance.** Petty, S.W. (Avco Everett Research Laboratory, Inc., Everett, Massachusetts 02149). *Proceedings, Intersociety Energy Conversion Engineering Conference;* 1: 131-137(Aug 1983). (CONF-830812—). Contract AC22-80ET15614.

From 18. intersociety energy conversion engineering conference; Orlando, FL, USA (21 Aug 1983).

A series of experiments was conducted on a slagging MHD generator to investigate the loss in channel performance brought about by slag polarization phenomena in which large reductions in slag resistivity are observed on the cathode wall. However, tests in which the seed was discontinued resulted in relatively no change in generated Hall voltage (about 500 volts) while power levels dropped to less than 1 kW, demonstrating minimal leakage in the slag layer. It is concluded that the cathode slag layer is not continuous but is periodically "broken". Shorting of Faraday currents in the presence of a Hall field results in increasing current concentrations at the downstream edge of the shorted group until sufficient joule heating is produced to locally remove or thin the slag layer and create an open insulator gap capable of sustaining the Hall voltage. The net effect was a resegmentation of the cathode wall from a design pitch of 1.5 cm to a pitch of between 4 and 10 cm depending on the iron oxide concentration in the ash.

7736 **Deposition of seed and slag in MHD steam plants (Work done under the auspices of the U.S. Department of Energy).** Smyk, E.B.; Chow, L.S.H.; Johnson, T.R.; Klinger, J.G.; Staffon, J.D. (Argonne National Laboratory, Argonne, IL). *Proceedings, Intersociety Energy Conversion Engineering Conference;* 1: 138-144(Aug 1983). (CONF-830812—).

From 18. intersociety energy conversion engineering conference; Orlando, FL, USA (21 Aug 1983).

At Argonne National Laboratory (ANL), the deposition rates of seed, K_2SO_4, and slag on cooled tubes, which represent the steam and air heaters in an MHD steam plant, are being measured and the characteristics of these fouling deposits studied. Some of the seed vapor condenses on the cooled surfaces but most of it condenses on entrained, submicron slag particles as the combustion gas cools. Thermophoresis is the most important deposition mechanism for the slag-seed particles. Particles larger than several micrometers, which occur as unvaporized slag particles entrained in the combustor exhaust gas, deposit mostly by inertial impaction. The effects of seed- and slag-laden flue gas on the convective sections of an MHD steam plant are simulated in the Fossil Energy Users Laboratory at ANL. Particulate measurements have shown that most of the K_2SO_4 particles have a diameter of about 0.3 μm in good agreement with theory. Seed vapor condensation rates of 1.2 to 1.5 $kg/m^2 \times h$ have been measured for a K_2SO_4 loading of 1.7 wt % in rough agreement with mass transfer theory. Measured deposition rates of submicron particles were also in rough agreement with the predictions of a thermophoretic deposition model. Tests completed to date support the premise that the convective sections of the MHD steam plant can be designed to operate efficiently and reliably.

7737 **Status of MHD testing at the U.S. Department of Energy's component development and integration facility (CDIF).** Staats, G.E.; Sherick, J.M. (Mountain States Energy, Inc.). *Proceedings, Intersociety Energy Conversion Engineering Conference;* 1: 151-154(Aug 1983). (CONF-830812—). Contract AC07-78ID01745.

From 18. intersociety energy conversion engineering conference; Orlando, FL, USA (21 Aug 1983).

This paper summarizes the status of MHD testing at the Component Development and Integration Facility for the past ten months. This facility has been commissioned by the United States

Department of Energy to test MHD components and provide development data at the nominal 50 MW /SUB t/ input level. Included is the CDIF testing projection for the future as presently defined. Because of the early paper submittal requirements additional testing information will be presented at the conference.

7738 **Results from integrated tests of a 50MW /SUB t/ MHD channel and inverter at the CDIF.** Farrar, L.C.; Ferraro, R.J.; Koester, J.K.; Ray, E.R. (Mountain States Energy, Inc., Butte, Montana). *Proceedings, Intersociety Energy Conversion Engineering Conference;* 1: 155-162(Aug 1983). (CONF-830812—). Contract AC07-78ID01745.

From 18. intersociety energy conversion engineering conference; Orlando, FL, USA (21 Aug 1983).

An important series of tests have been completed at the Component Development and Integration Facility (CDIF); MHD generated DC power was transmitted as three-phase AC power to the commercial power grid, via a line-commutated inverter. Test results presented show the inverter to be a useful tool for characterization of MHD channel electrical output as a function of various plasma and load conditions, during both transient and steady-state operations. Coupled MHD channel-to-inverter operation was achieved and sufficient data were gathered to verify inverter operation in three modes: voltage, current, and impedance. An overall DC to AC power transfer relationship was established and an evaluation of inverter output characteristics including voltage, current, and power factor, were obtained. Load characteristics for maximum MHD channel power output and sensitivity of the MHD channel performance to a wide range of external load settings were determined. During the test series, 2.7 MWh of three-phase AC power was transmitted to the commercial power grid.

7739 **MHD channel electrical boundary-layer theory and applications.** Zwick, S.A.; Doss, E.D.; Pan, Y.C.; Shamma, S.E. (Argonne National Laboratory, Argonne, Illinois). *Journal of Energy;* 7: No. 2, 118-127(Mar 1983).

Analytical methods are developed for calculating the potential and currents near boundary singularities caused by electrode edges or abrupt drops in conductivity or in the induction field. A three-dimensional control volume (finite-difference) model which applies the analysis for solving the magnetohydrodynamic electrical problem in oblique coordinates has been developed. The model accounts for the near-wall singular behavior accurately and can be used with relatively sparse grids to study channels with diagonal sidewall conductors. Analyses based on the model indicate that, for practical generator design where the electrode pitc is on the order of from 1 to 5 cm and the wall temperature less than 2100 K, the performance of diagonal conducting wall channels is always superior to that of channels with insulating sidewalls, although the performance of insulating sidewall channel is better at higher wall temperatures. Sidewall electrode extensions up to a wraparound of about 20% of the channel height are shown to cause an increase in power output. The power output of diagonally connected channels remains approximately the same for more than 20% wraparound, whereas the power output of Faraday channels drops off with further extensions of the sidewall conductors.

7740 **Cross-sectional current distribution in coal fired diagonal conducting wall MHD generator.** Kumarah, A.R.; Liu, B.L.; Wu, Y.C.L. (The University of Tennessee Space Institute, Tullahoma, Tennessee). *Journal of Energy;* 7: No. 2, 112-117(Mar 1983). Contract AC02-79ET10815.

Current distribution in the cross-sectional plane of a diagonal conducting wall MHD generator with slag coated walls is studied. The effects of boundary layer thickness and wall temperature on the current distribution and power output are investigated for magnetic fields of 2 and 6 T. The effect of sidewall boundar layer overshoot is also considered. For a cold wall there is substantial current flow to the sidewalls, whereas for a hot wall there is much less such a trend. The change in the thickness of the turbulent boundary layer has little effect on the current distribution and power output. Increasing the Hall parameter enhances the sidewall current significantly. Power output is strongly dependent on the wall temperature since the voltage drop increases rapidly as the wall temperature decreases. The temperature distribution in the slag layer varies with the current density for a specified wall temperature. There is no substantial current leakage through the slag layer between the various electrodes along the sidewall in all the cases considered. The poweroutput from the present investigation compares well with the experimental results and also with three-dimensional results.

7741 **Development of single stage toroidal flow coal fired MHD combustor.** Stankevics, J.O.A.; Beals, R.C.; Mattsson, A.C.J.; Stewart, C.C. (Avco Everett Research Laboratory, Inc.). *Proceedings, Intersociety Energy Conversion Engineering Conference;* 3: 1208-1216(Aug 1982). (CONF-820814—). Contract AC22-78ET10787.

From 17. Intersociety Energy Conversion Engineering conference; Los Angeles, CA, USA (8 Aug 1982).

Studies and testing done at the Avco Everett Research Laboratory, Inc. (AERL) have considerably advanced the state-of-the-art of MHD coal-fired combustor design and operation. A prototype 20 MW MHD coal-fired combustor was designed, fabricated and tested. The slagging coal combustor design concept is a single-stage configuration which enables the achievement of high overall thermal efficiency. The vertical combustor has a downward flow, a cylindrical chamber, and a horizontal exit nozzle for directing the seeded plasma to a MHD generator channel. Combustion experiments at operating pressures up to 6 atm yielded the following data: combustion temperature of 2650-2800°K, electrical gas conductivity of 6 to 7 mhos/meter, carbon utilization greater than 99.5%, and stable steady state operation.

7742 **1000 Hour MHD anode test.** Hruby, V.J.; Kessler, R.; Petty, S.W.; Weiss, P. (Avco Everett Research Laboratory, Inc., Everett, Massachusetts). *Proceedings, Intersociety Energy Conversion Engineering Conference;* 3: 1223-1228(Aug 1982). (CONF-820814—). Contract AC22-80ET15614.

From 17. Intersociety Energy Conversion Engineering conference; Los Angeles, CA, USA (8 Aug 1982).

Various anode electrodes for MHD channels were recently operated successfully for over 1000 hours under the same electrical, thermal and chemical stress conditions as would exist in a commercial MHD power plant, including the requisite fractions of sulfur and coal ash carry-over. The most successful electrodes were made of water-cooled copper with platinum and/or stainless steel cladding in critical areas. Based on measured erosion rates for the 1000 hours of operation actually achieved, an ultimate lifetime in the range 5000 to 8000 hours can be extrapolated for these electrodes.

7743 **Seed-slag fouling and corrosion in an MHD steam bottoming plant.** Chow, L.S.H.; Dunn, P.F.; Johnson, T.R.; Natesan, K.; Reed, C.B.; Schlenger, B.J. (Argonne National Laboratory, Argonne, IL). *Proceedings, Intersociety Energy Conversion Engineering Conference;* 3: vp(Aug 1982). (CONF-820814—).

From 17. Intersociety Energy Conversion Engineering conference; Los Angeles, CA, USA (8 Aug 1982).

At the Argonne MHD Process Engineering Laboratory (AMPEL), five fouling tests have been carried out to investigate the deposition of seedash deposits that form on tubes in the convective sections of the MHD/steam bottoming plant. The effect of these deposits on heat transfer, their tenacity, composition, and effective thermal conductivities were determined. In these tests, combustion gas containing ash particles and K_2SO_4 was passed through a bank of 15 vertical, cooled tubes, which simulated a steam superheater or reheater. In addition to these fouling tests, long duration corrosion tests of commercial-grade metal alloys have been conducted in the laboratory under controlled conditions of gas and metal temperatures, gas chemistry, and deposit compositions. The tests completed to date support the premise that the convective sections of the MHD/steam bottoming plant can be designed to operate efficiently and reliably, and that suitable metal alloys are commercially available.

7744 **Development of superconducting dipole magnets at Argonne National Laboratory for open-cycle MHD research.** Smith, R.P. (Argonne National Laboratory, Argonne, IL). *Proceedings, Intersociety Energy Conversion Engineering Conference;* 2208-2213(Aug 1982). (CONF-820814—).

From 17. Intersociety Energy Conversion Engineering conference; Los Angeles, CA, USA (8 Aug 1982).

Design and fabrication experiences at Argonne National Laboratory (ANL) with the pioneering U-25B five tesla superconducting MHD magnet, the six tesla CFFF superconducting MHD magnet, and the operational experiences with the U-25B magnet in an open-cycle MHD environment at the Institute for High Temperatures in Moscow, USSR, have provided unique data for critical aspects of superconducting magnet development for the generation of electrical power using open cycle MHD energy conversion.

7745 **Results of large scale MHD generator experiments.** Whitehead, G.L.; Christensen, L.S. (Arvinl Calspan Field Service Inc./AEDC Division, Arnold Air Force Station, Tennessee 37389). *Energy Technology (Washington, D.C.);* 9: 1017-1032(Jun 1982). (CONF-820217—).

From 9. energy technology conference; Washington, DC, USA (16 Feb 1982).

A high performance demonstration experiment (HPDE) is in progress to prove that a 300-MW thermal input open-cycle MHD system generator can convert a percent of the available thermal energy into electrical power. The facility is described in detail: combustor system, the magnet system, the generator channel, the HPDE diffuser, and an HPDE data system. The run sequence includes cooling water and pilot purge flows, fuel flows, igniter and pilot activation, and the oxidized flow.

3003 Thermoelectric Generators

7746 **Small-polaron electronic transport in boron carbides.** Emin, D.; Wood, C. (Sandia National Laboratories, Albuquerque, NM). *Proceedings, Intersociety Energy Conversion Engineering Conference;* 1: 222-226(Aug 1983). (CONF-830812—). Contract AC04-76DP00789.

From 18. intersociety energy conversion engineering conference; Orlando, FL, USA (21 Aug 1983).

Electrical transport measurements indicate that the charge carriers form small polarons. Here, conduction is due to a large (nearly degenerate) density of small polarons which move via hopping. A unique and significant feature of the Seebeck coefficient is that here, in a disordered small-polaron material, vibrational energy is transported with the carrier as it hops. This gives rise to an augmentation of the Seebeck coefficient which rises with temperature. In a degenerate small-polaron material this term produces a figure-of-merit for a high-temperature thermoelectric generator which is greater than the maximum estimated previously by Heikes.

7747 **Thermoelectric properties of ytterbium sulfides.** Takeshita, T.; Beaudry, B.J.; Gschneider, K.A. (Ames Laboratory, Iowa State University, Ames, IA). *Proceedings, Intersociety Energy Conversion Engineering Conference;* 1: 240-244(Aug 1983). (CONF-830812—).

From 18. intersociety energy conversion engineering conference; Orlando, FL, USA (21 Aug 1983).

Only a few rare earth sulfides are known to have p-type electrical conductivity. Ytterbium sulfides are among those in this select group. This behavior is believed to be due to the mixed valency of ytterbium cations in the compounds. In addition the thermal conductivity of some ytterbium sulfides is shown to be quite small. These osbervations suggest that ytterbium sulfides would be worthwhile to study as high temperature p-type thermoelectric materials. This investigation is concerned with the preparation and measurement of the thermoelectric power and electrical conductivity measurements of binary ytterbium sulfides and ternary ytterbium-calcium, -barium and -vanadium sulfides.

7748 **Retrieval of RTG'S in earth orbit.** Raab, B.; Frieder, M.A.; Skrabek, A. (Fairchild Space & Electronics Co., Germantown, Maryland). *Proceedings, Intersociety Energy Conversion Engineering Conference;* 3: 1392-1396(Aug 1982). (CONF-820814—).

From 17. Intersociety Energy Conversion Engineering conference; Los Angeles, CA, USA (8 Aug 1982).

Since 1961, some ten Radioisotope Thermoelectric Generators (RTG's) have been placed into a variety of spacecraft which are now in earth orbit. All of these spacecraft are in orbits with lifetimes in excess of 100 years and pose no risk. However, since most of these spacecraft are no longer being actively used, these may be subject to an active removal program to reduce the population of objects in space. Therefore, a study was undertaken to evaluate the feasibility of retrieving or disposing of spacecraft with RTGs on board. Intervention scenarios are developed and an orbital rendezvous vehicle is conceptualized. The costs of RTG retrieval are derived and compared to the costs of RTG disposal, i.e., boost to a higher, multi-millenium-lifetime orbit, and are found to be not significantly different.

7749 **The Sodium Heat Engine: a new approach to direct heat-to-electricity conversion.** Hunt, T.K.; Weber, N. (Engineering and Research Staff, Dearborn, Michigan 48121). *Energy Technology (Washington, D.C.);* 9: 498-504(Jun 1982). (CONF-820217—). Contract AC02-79ER10347.

From 9. energy technology conference; Washington, DC, USA (16 Feb 1982).

Sodium Heat Engine (SHE) is a new type of energy conversion device capable of direct conversion of heat into electric energy using any thermal source delivering heat at 700-1000c. The device operates by extracting electrical energy from the electrochemical expansion of sodium vapor across a beta ″-alumina solid electrolyte. A diagram and key explanation are given. Voltage-current relation, efficiency equations (including major parasitic loss term) are derived. Attractive features of SHE include its simplicity, high efficiency, external combustion, high power density, and materials. Applications of SHE are suggested, and current status of tests of small SHE systems capable of operating from more realistic heat sources is reviewed.

3004 Thermionic Converters

7750 **High performance, close-spaced thermionic converters.** Dick, R.S.; Britt, E.J.; Fitzpatrick, G.O.; McVey, J.B. (Rasor Associates, Inc., Sunnyvale, California). *Proceedings, Intersociety Energy Conversion Engineering Conference;* 1: 198-201(Aug 1983). (CONF-830812—). Contract AC02-76ET11292.

From 18. intersociety energy conversion engineering conference; Orlando, FL, USA (21 Aug 1983).

Near ideal performance in a Thermionic Energy Converter (TEC) can be obtained using extremely small (< 10 microns) interelectrode spacings. Previous efforts to build such converters have encountered engineering problems. A new type of converter, called SAVTEC (for Self-Adjusting, Versatile Thermionic Energy Converter) has been developed at Rasor Associates, Inc., as a practical way to achieve small spacings. It has been demonstrated to deliver improved performance over conventional, ignited-mode converters. A series of individual SAVTEC's have been built and tested. Two general configurations were built: in the first a single emitter support lead (0.25 mm wire) passes through a hole in the center of the collector, with the emitter being welded to it. In the second three smaller wires replace the center wire and are welded to the emitter perimeter. These converters have shown reliable, temperature controlled spacings of the emitter and collector. Reproducible spacing of 10 microns (0.4 mils) were achieved on several converters. This paper presents details of SAVTEC converter construction and performance, including volt-ampere curves.

7751 **Development and evaluation of directionally solidified Cermet electrodes for thermionic energy converters.** Wolff, L.R.; Danielson, L.R.; Gubbels, H.M.; Huffman, F.; Metselaar, R.; Saunders, M. (Laboratory for Physical Chemistry, Eindhoven University of Technology). *Proceedings, Intersociety Energy Conversion Engineering Conference;* 1: 202-207(Aug 1983). (CONF-830812—). Contract AC02-76ET11292.

From 18. intersociety energy conversion engineering conference; Orlando, FL, USA (21 Aug 1983).

At Eindhoven University of Technology, the high temperature materials research group HOTEMA is currently developing a new type of emitter electrode for thermionic energy converters. These Cermet electrodes consist of a refractory metal substrate coated with a directionally solidified metal-ceramic eutectic. In a

joint research program, emitter materials produced in Eindhoven are evaluated by Thermo Electron in Waltham. A research diode incorporating a directionally solidified Mo-Al_2O_3,Cr_2O_3 Cermet emitter was build and tested. This converter exhibited stable performance at emitter temperatures up to 1650K. The barrier index at T /SUB E/ = 1400K was 2.04 eV. Minimum collector work function as measured by the retarding plot method was 1.53 eV. This low work function may be related to oxygen which as post operational Auger analyses showed was present at both emitter and collector. These results suggest that an emitter of this type has potential of providing significantly improved thermionic converter performance.

7752 **Thermionic cogeneration burner design.** Miskolczy, G.; Goodale, D.; Moffat, A.L.; Morgan, D.T. (Thermo Electron Corporation, Waltham, MA 02254). *Proceedings, Intersociety Energy Conversion Engineering Conference;* **1**: 186-191(Aug 1983). (CONF-830812—). Contract AC02-82CE40582.

From 18. intersociety energy conversion engineering conference; Orlando, FL, USA (21 Aug 1983).

Since thermionic converters receive heat at very high temperatures (approximately 1800 K) and reject heat at moderately high temperatures (approximately 800 K), they are useful for cogeneration applications involving high temperature processes. The electric power from thermionic converters is produced as a high amperage, low-voltage direct current. An ideal cogeneration application would be to utilize the reject heat at the collector temperature and the electricity without power conditioning. A cogeneration application in the edible oil industry fulfills both of these requirements since both direct heat and hydrogen gas are required in the hydrogenation of the oils. In this application, the low voltage direct current would be used in a hydrogen electrolyzer.

7753 **Combustion converter development for topping and cogeneration applications.** Goodale, D.; Lieb, D.; Miskolczy, G.; Moffat, A. (Thermo Electron Corporation, Waltham, MA). *Proceedings, Intersociety Energy Conversion Engineering Conference;* **1**: 192-197(Aug 1983). (CONF-830812—). Contract AC02-76ET11292.

From 18. intersociety energy conversion engineering conference; Orlando, FL, USA (21 Aug 1983).

This paper discusses the development of combustion-heated thermionic converters. Combustion applications pose a materials problem that does not exist for thermionic converters used in the vacuum of outer space. The high-temperature components of a thermionic converter must be protected from the oxidizing terrestrial environment. A layer of silicon carbide provides the most satisfactory protective coating, or "hot shell," for the emitter and lead of a combustion-heated thermionic converter. Four areas of work aimed at developing combustion heated thermionic converters will be discussed: improving the performance of the two-inch torispherical converter, modifications to the converter so that it may be used in multi-converter modules, the construction of a thermionic cogeneration test furnace, and a converter life test in an oil-fired furnace.

7754 **Solar thermionic energy converter experiment.** Goodale, D.; Lieb, D.; Neale, D. (Thermo Electron Corporation, Waltham, MA). *Proceedings, Intersociety Energy Conversion Engineering Conference;* **4**: 1924-1929(Aug 1982). (CONF-820814—). Contract AC02-76ET11292.

From 17. Intersociety Energy Conversion Engineering conference; Los Angeles, CA, USA (8 Aug 1982).

A one-inch CVD converter was solar tested in a central receiver heliostat array at the Advanced Components Test Facility at the Georgia Institute of Technology. The test examined heat flux cycling control of the operating point and mounting arrangements. The converter was mounted directly in the solar image with no cavity. The input heat flux was 40-60 W/cm^2. The converter performance was comparable to combustion measurements made on the same diode. Thermal cycling caused no problems with converter operation. The converter showed no degradation after the test.

3005 Fuel Cells

REFER ALSO TO CITATION(S) 7104, 7352, 7353, 7725

7755 **(CONF-840201—3) Molten carbonate fuel cells for coal and natural gas fuels.** Krumpelt, M.; Cook, G.M.; Pierce, R.D.; Ackerman, J.P. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 5p. NTIS, PC A02/MF A01. Order Number DE84003624.

From ASME energy sources technology conference and exhibition; New Orleans, LA, USA (12 Feb 1984).

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System designs of molten carbonate fuel cell power plants are deacribed for central stations using coal and on-site generators operating on natural gas. Fuel-to-busbar efficiencies are near 50% in coal based systems with turbine bottoming and in simple gas based systems. Coal based systems with more advanced but not fully developed components, and more complex gas based systems approach 60% efficiency.

7756 **(DOE/ET/15440—T1) Development of molten carbonate fuel cell power plant technology. Quarterly technical progress report No. 14, January 1, 1983-March 31, 1983.** (United Technologies Corp., South Windsor, CT (USA). Power Systems Div.). Apr 1983. Contract AC02-79ET15440. 30p. NTIS, PC A03/MF A01. Order Number DE84002367.

The overall objective of this program is to develop and verify the design of a prototype molten carbonate fuel cell stack which meets the requirements of a 1990's-competitive coal-fired electrical utility central station or industrial cogeneration power plant. Progress is reported.

7757 **A long-lived external Ag/AgCl reference electrode for use in high temperature/pressure environments.** Danielson, M.J. (Battelle, Pacific Northwest Laboratory, Richland, Washington). *Corrosion (Houston);* **39**: No. 5, 202-203(May 1983). Contract AC06-76RL01830.

High temperature pressure Ag/AgCl electrodes resistant to the contaminating effects of H_2 and H_2S were described in 1979. But the external reference electrode suffers from a thermal liquid junction potential (TLJP) and the development of the Soret effect (thermo-diffusion of the electrolyte). This paper describes a design to improve electrode life. A silvered-tube replaces the silver wire electrode. A liquid chromatograph minipump is used to slowly inject KCl solution into the electrode to maintain a "front" of fresh solution. This prevents ageing effects, and the Soret effect. Construction specifications are given for: corrosion resistant tubing, electrical gland end, zirconium yarn, titanium tubing, polyimide collar, PTFE tubing, minipumps for chromatograph, zirconia plug, and silver chloride.

32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION

7758 **(NP—3770178) Topical problems in Bavarian energy supplies.** Lupberger, B. (Bayernwerk A.G., Muenchen (Germany, F.R.)). 1982. 34p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83770178.

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The publication consists mainly of graphs serving to illustrate the development of energy supplies in the Federal Republic of Germany and especially in Bavaria in the last two decades until about 1981.

7759 **(ORNL—5982) Local government programs to save energy: case studies of four selected communities.** Schweitzer, M.; Carnes, S.A. (Oak Ridge National Lab., TN (USA)). Sep 1983. Contract W-7405-ENG-26. 73p. NTIS PC A04/MF A01. Order Number DE84004197.

A variety of programs to save energy in the public and private sectors has been undertaken by state and local governments throughout the country. A number of these programs have re-

ceived financial assistance from the federal government through the State Energy Conservation Program (SECP) and the Energy Extension Service (EES). Four such federally assisted efforts, in which state and local governments worked together to increase energy efficiency in a specific target community, were selected for in-depth study to provide information and assistance for other states and communities interested in undertaking similar activities. The four case study sites were Austin, Texas; New Castle County, Delaware; Peoria, Illinois; and Rock Hill, South Carolina. In Austin, extensive energy planning and implementation have been performed under a state Comprehensive Community Energy Management Program. In New Castle County, extensive energy management efforts were undertaken by local government and a stringent energy-conserving building code was enacted. Peoria was the site of a two-month public awareness campaign called Project Peoria, during which numerous workshops, conferences and other events to stimulate energy efficiency took place. Finally, Rock Hill was studied for its community-wide Energy Futures Conference which charted future directions for the community and spawned subsequent implementation activities. Information on these community efforts was gathered through a combination of site visits, personal and telephone interviews, and document reviews.

3201 Buildings

REFER ALSO TO CITATION(S) 7338, 7342, 7343, 7344, 7345, 7396, 7416, 7423, 7424, 7425, 7431, 7432, 7433, 7705, 8275, 8276

7760 (BMFT-FB-T—83-169) Thermostatic fine control valves mounted to the radiators in district heating systems. Dausch, H.J.; Schelowsky, H.U.; Winkens, H.P. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Aug 1983. 439p. (In German). NTIS (US Sales Only), PC A19/MF A01. Order Number DE84750046.

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Objectives of the investigation were to investigate 1.) whether existent thermostatic fine control valves, with regard to control features, are suitable for use in highly spread district heating systems to realize lower return temperatures; 2.) what efficiency will result from this for the public district heat supply services and for the customers; 3.) whether the house substations for small customers' installations can be simplified. Furthermore thermostatic valves have been tested in connection with flow heaters with the aim to save costs. According to the findings of the investigations the return temperatures can be decreased efficiently with the aid of thermostatic fine control valves. The valves work reliably in highly spread district heating systems. Considerable economic advantages may result for the district heating plant and for the customers. With the aid of thermostatically controlled flow heaters the return temperatures can be efficiently reduced also in summer, and customers' installations may be considerably lowered in price.

7761 (CONF-831115—1) Potential for improved energy efficiency in existing homes in the Pacific Northwest. Hirst, E.; Goeltz, R. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 5p. NTIS, PC A02/MF A01. Order Number DE84004578.

From 6. world energy engineering congress; Atlanta, GA, USA (29 Nov 1983).

Analysis of results from home energy audits conducted in the Pacific Northwest show large potential reductions in electricity use. The average saving, across 359 audited all-electric single-family homes, is 7070 kWh/year, 34% of estimated preaudit consumption. Measures installed in these homes, as part of the Bonneville Power Administration Residential Weatherization Pilot Program, cut consumption by an estimated 6200 kWh/year, at an average cost of $2100. Comparison of actual reductions in electricity use with audit predictions showed that the ratio of actual to predicted saving averaged 78%.

7762 (CONF-8209182—Suppl.) Briefing package for heat-pump-modeling workshop. Rice, C.K.; Fischer, S.K.; Ellison, R.D.; Emmerson, C.J. (Oak Ridge National Lab., TN (USA)). 1982. Contract W-7405-ENG-26. 265p. NTIS, PC A12/MF A01. Order Number DE84000683.

From Heat pump modeling workshop; Oak Ridge, TN, USA (22 Sep 1982).

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Graphics, flow charts, and diagrams for the workshop are included. No papers. These materials include: ORNL Heat Pump Model, recent heat pump design optimization studies, model validation, refrigerant- and air-side pressure drop calculations, fan power calculations, flow control devices that can be modelled directly, future work, compressor models, loss and efficiency compressor model, heat exchanger modelling, seasonal performance modelling, and dehumidification calculations. (MHR)

7763 (DOE/BP—194) BPA launches the Hood River conservation project. (USDOE Bonneville Power Administration, Portland, OR). Nov 1983. 3p. NTIS, PC A02/MF A01. Order Number DE84005011.

The Bonneville Power Administration (BPA) is embarking upon the most aggressive conservation program ever described. One focus of BPA's pioneering efforts is the Hood River Conservation Project, a project which will make the city of Hood River and the surrounding area a model of conservation practices for the nation. The 2-year, $20 million research project aims to discover how much electric energy a community can save under almost ideal conditions. BPA will pay homeowners in the city and county of Hood River for the full cost of tightening houses and installing insulation to very high levels. The weatherization effort will be accompained by aggresive advertising to inform and involve the entire community in the BPA project. These measures will include 16 inches of ceiling insulation, 13 inches of floor insulation, up to the equivalent of 6 inches of wall insulation, triple glazing on windows, caulking, weatherstripping, dehumidifiers and heat exchangers where necessary, switchplate gaskets, electric water heater wraps, water flow regulators, and flow restricting shower heads. The first home to be weatherized and its occupants are described.

7764 (DOE/CS/20560—T1) Energy conservation study: Amalgamated Warbasse Houses Inc., Total Energy Plant, Brooklyn, New York. Final report. (American Hydrotherm Corp., New York). [nd]. Contract FG01-80CS20560. 167p. NTIS, PC A08/MF A01. Order Number DE84004773.

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Amalgamated Warbasse Houses is a private cooperative housing complex located in the Coney Island Section of Brooklyn, New York. The project was amongst the first of its kind by which a cooperative housing complex incorporated a total energy power plant. Studies originally made prior to construction cited the total energy concept to be the most efficient and economical method of providing the necessary utilities to the complex. The five high rise multisection buildings, twenty three stories each, contain 2585 dwelling units. They also contain professional suites, community center, and preschool learning center. The self sufficient complex includes a small shopping center. The total energy power plant provides one hundred percent of the electrical, heating, cooling and domestic hot water requirements of the apartments. The power plant is not connected in any manner to the local utility power grid, and has no alternative source of power.

7765 (DOE/CS/24101—T1) Land use planning and development. Final technical report. (Urban Land Inst., Washington, DC (USA)). 1983. Contract FG01-80CS24101. 5p. NTIS, PC A02/MF A01. Order Number DE84004963.

The objective of the grant was to promote energy-efficient environmentally-sound communities through a better understanding of land use planning and development. The materials in furtherance of that objective are described.

7766 (DOE/CS/30525—25) Honeycomb insulating shade. (Kool View Co., Inc., Madison, WI (USA)). Aug 1983. Contract FC02-80CS30525. 59p. NTIS, PC A04/MF A01. Order Number DE84001270.

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Effective passive solar heating systems and conventional residential windows require the incorporation of an operable thermal barrier into the window design, which saves both money and energy. This product was developed with the following objectives: (1) provides high window insulating value to reduce nighttime Btu

losses or excessive daytime heat gain, (2) provides interior comfort, privacy and light control, (3) is cost effective and competitive, (4) is easy to install and operate, and (5) is aesthetically pleasing and adaptable to any decor. The thermal barrier is made of a special nonconductive material formed into a flexible honeycomb structure which is placed on the interior of windows. When expanded it forms multiple dead air spaces that are vertical and parallel to the surface of the glazing interface. The honeycomb cells are dimensionally designed to stop convection from occurring within the cell. When the paper/cloth material is fabricated into a honeycomb structure and placed on the interior of the windows, it forms multiple dead insulating air cells and reduces or stops convection between the window and the honeycomb thermal barrier. The corresponding hardware utilizes conventional curtain traverse rods that are found in the majority of homes or are inexpensively purchased by the consumer. The thermal barrier can be hung on the interior of the window and manipulated by a wand or cord to the open and closed positions. Massive window areas can use motor assisted operation to provide greater efficiency.

7767 **(DOE/NBM—4004261) Bibliography of resource materials for the residential conservation service and commercial and apartment conservation service programs.** Ehrenshaft, A.R.; Mixon, W.R.; Karnitz, M.A. (Oak Ridge National Lab., TN (USA)). May 1983. Contract W-7405-ENG-26. 13p. NTIS, PC A02/MF A01. Order Number DE84004261.

The Residential Conservation Service (RCS) and the Commercial and Apartment Conservation Service (CACS) Programs were established by the National Energy Conservation Policy Act (NECPA) of 1978 as amended by the Energy Security Act of 1980. Since the inception of the RCS, research activities were sponsored which have provided regulatory and technical support to program participants such as federal legislators and policy makers, utility companies, state energy offices, and public service commissions. In order to facilitate identification and retrieval of the resource materials produced by these research activities, this bibliography has been compiled. The contents of the bibliography have been grouped according to subject matter. Within each group, the documents have been arranged alphabetically by title. The Engineering Analysis of Program Measures Section includes research projects which describe contract reports that will be made available to the public in the near future.

7768 **(DOE/R6/10956—T1) Final technical report, September 1, 1979-July 24, 1980. Solar window system.** Briggs, J.D.; Mizell, B. (Briggs (James D.), Kerrville, TX (USA)). Jul 1980. Contract FG46-79R610956. 32p. NTIS PC A03/MF A01. Order Number DE84003508.

A solar window system is designed to be fitted into a window frame of a building or over an existing window, the invention window system functioning as a combination shade awning, solar reflector and thermal-security shutter. The invention solar window system comprises a frame, an adjustable insulated panel having reflective surfaces and supporting adjusting means for the panel. Glass may or may not be fitted into the frame depending upon the solar window system's intended use. According to the adjustment of the panel, the invention window system can function as a shade awning, as a solar reflector, or as a thermal-security shutter.

7769 **(DOE/R6/12037—T1) Electronically controlled high efficiency heat pump. Technical and performance report.** Woods, R.A. (Woods (Ray A.), Fairview, OK (USA)). [nd]. Contract FG46-80R612037. 3p. NTIS, PC A02/MF A01. Order Number DE84002505.

The efficiency and effectiveness of an electronic power-monitoring device to control the head pressure in a heat pump system was demonstrated and measured. (MHR)

7770 **(NP—3770158) Comparison of heating systems.** Graemiger, K.; Nussbaum, M. (Eidgenoessische Technische Hochschule, Zurich (Switzerland)). Aug 1981. 74p. (In German). Eidgenoessische Technische Hochschule, Zurich (Switzerland). Inst. fuer Hochbauforschung.

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Report of a building project in Faellanden in the Kanton Zuerich. The project includes five terraced houses with different floor plans. The houses have three storeys and no cellar. The simple design of the residential units are made up for by the large availability of space and volume. The project description comprises not only the major plans but also the description and n-factor of the components relevant for the calculation of the energy demand.

7771 **(ORNL/CON—136) Evaluation of home energy audit and retrofit loan programs in Minnesota: the Northern States Power experience.** Hirst, E.; Goeltz, R.; Thornsjo, M.; Sundin, D. (Oak Ridge National Lab., TN (USA); Northern States Power Co., Minneapolis, MN (USA)). Dec 1983. Contract W-7405-ENG-26. 130p. NTIS, PC A07/MF A01. Order Number DE84004151.

Northern States Power NPS, the largest utility in Minnesota, operates several residential energy conservation programs. A detailed quantitative evaluation of two of these programs is described. The Minnesota Energy Conservation Service (MECS), provides home energy audits and related services to eligible households (who live in structures with four or fewer dwelling units and pay gas or electricity bills to a utility participating in MECS). Loans are available to a portion of NSP's customers for installation of retrofit measures recommended in a MECS audit: low-interest installment loans to City of St. Paul households and deferred payment low-interest loans to a pilot group of St. Paul area households (constituting one of NSP's Public utility Conservation Investment Programs, PUCIP). This evaluation showed that NSP's MECS and PUCIP programs led to statistically significant energy savings. The value of these energy savings was sufficient to make the programs cost-effective to participants; however, the programs are not economically attractive to NSP nonparticipating ratepayers when viewed from the perspective of minimizing natural gas rates. The economics of the MECS program are neutral from the social (i.e., state) perspective. The PUCIP program is not cost-effective to the state.

7772 **(ORNL/CON—139) Selection of states for evaluation of the Residential Conservation Service.** Tonn, B. (Oak Ridge National Lab., TN (USA)). Nov 1983. Contract W-7405-ENG-26. 59p. NTIS, PC A04/MF A01. Order Number DE84004130.

The purpose of this study is to guide the selection of a subset of states for in-depth evaluation concerning the character and magnitude of Residential Conservation Service (RCS) benefits and costs. Two methodologies are applied to the state selection problem. One utilizes cluster analysis in order to place states in clusters or groups which may exhibit similar RCS benefit-cost characteristics. The strategy is to evaluate one state per cluster, determine the benefits and costs per RCS audit for that state, and then generalize these results to the other states in the cluster. The other methodology uses an optimization technique to search for the subset of state which exhibits maximum variation over a number of variables which are deemed important contributors to RCS benefits and costs. The national evaulation strategy is to determine how benefits and/or costs vary as the magnitude of each variable varies, using information from the in-depth evaluations. One would need only to ascertain the value of each variable for each of the remaining states and input the values into the various benefit/cost relationships to obtain a national RCS benefit-cost estimate.

7773 **(ORNL/Sub—78-7229/4) Research and development of energy-efficient appliance motor-compressors. Volume IV. Production demonstration and field test.** Middleton, M.G.; Sauber, R.S. (Kelvinator Compressor Co., Grand Rapids, MI (USA)). Sep 1983. Contract W-7405-ENG-26. 72p. NTIS, PC A04/MF A01. Order Number DE84005083.

Two models of a high-efficiency compressor were manufactured in a pilot production run. These compressors were for low back-pressure applications. While based on a production compressor, there were many changes that required production process changes. Some changes were performed within our company and others were made by outside vendors. The compressors were used in top mount refrigerator-freezers and sold in normal distribution channels. Forty units were placed in residences for a one-year field test. Additional compressors were built so that a life test program

could be performed. The results of the field test reveal a 27.0% improvement in energy consumption for the 18 ft^3 high-efficiency model and a 15.6% improvement in the 21 ft^3 improvement in the 21 ft^3 high-efficiency model as compared to the standard production unit.

7774 **(ORNL/Sub—82-22293/1) Energy savings potential of roofing research.** Chang, T.C.; Busching, H.W. (Clemson Univ., SC (USA). Dept. of Civil Engineering). Dec 1983. Contract W-7405-ENG-26. 219p. NTIS, PC A10/MF A01. Order Number DE84004220.

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This report quantifies energy savings that would accrue through use of increased roof insulation and describes low-slope roofing system research which would conserve energy. Adding insulation to uninsulated or poorly insulated low-slope roofs would save as much as 730,000 billion Btu - about 1% of the total annual US energy consumption; while, increasing the service life of low-slope roofs by one year would save approximately 42,000 billion Btu - about 0.06% of the total annual energy consumed. Estimates regarding low-slope roof areas and national energy savings potential from conserving space heating and cooling energy wasted through the low-slope roof areas were developed. In addition, estimates of the relative quantities of different low-slope roofing systems currently in place and trends have been summarized. Significance of the effects of solar radiation on thermal energy losses and gains through roofs were reviewed. Embodied energies of several typical low-slope roofing materials and systems have been examined and/or estimated. Savings of embodied energy attributable to increasing roof life by one year were estimated together with payback periods for embodied energy used in typical low-slope roofing systems. Estimates have also been developed for variations in the mass of common roofing systems and for a range of thermal time lags. Different mechanical attachment techniques have been described and estimates of energy costs resulting from these techniques are reviewed.

7775 **(TVA/OP/EDT—84/10) Ground coupled air-to-air (crawl space) heat pumps. Final report, October 1, 1980-May 31, 1982.** Reid, R.L.; Wasserman, D.M.; McGraw, B.A. (Tennessee Univ., Knoxville (USA)). Jul 1982. 235p. NTIS, PC A11/MF A01 - GPO. Order Number DE84900618.

A simple and inexpensive way to utilize the energy stored in the soil beneath a house to increase the efficiency of an air-to-air heat pump has been examined both experimentally and analytically. The outdoor unit of an air-to-air heat pump has been installed in an instrumented crawl space beneath an occupied residence in Alcoa, Tennessee. Air is pre-conditioned by the crawl space soil before passing over the outdoor unit coil. A heat pump seasonal performance factor model was used to compare heating and cooling season performance of the crawl space heat pump to the performance expected had the outdoor unit been conventionally installed. Results indicated a significant reduction in purchased energy during the heating season, particularly during peak load periods. Peak heating load purchased energy was calculated to be reduced by 26.3%, and total heating season purchased energy reduced by 14.4% with the use of a crawl space heat pump. Results for the cooling season indicate that the crawl space heat pump performed better than a conventionally installed heat pump during periods of high ambient temperatures. Peak cooling load purchased energy was calculated to be 7.4% less for the crawl space heat pump. A model of heat transfer in a crawl space was developed, and a computer program written to calculate time dependent soil and air temperatures in a crawl space containing a heat pump.

7776 **Anatomy of an energy management program.** Grumman, D.L.; Butkus, A.S. (Grumman/Butkus Assoc., Evanson, Illinois). *ASHRAE (American Society of Heating, Refrigeration and Air-Conditioning Engineers) Journal;* **25**: No. 6, 36-39(Jun 1983).

This article describes how a 1,100-bed medical center in Chicago instituted an energy management program that contains all the elements of a comprehensive and effective energy conservation effort. A substantial amount of cost sharing funds for technical assistance studies and implementation of recommended energy conservation was provided by the US DOE through the Institutional Buildings Grant Program (IBGP). Air-to-air heat recovery and results to date are discussed. The energy management program at the hospital has shown how a concerted effort involving in-house engineering staff, outside energy consultation and top management support can make substantial inroads on energy use. The Institutional Buildings Grant Program has provided a powerful incentive to carry out and continue with such a program. Medical facilities inherently have many excellent opportunities for improvements in energy efficiency, especially in areas such as heat recovery and revised temperature control strategies that are not obvious to laymen.

7777 **A comprehensive energy management program for commercial and residential buildings.** Shehadi, M.T. (Charles E. Smith Management Inc., Arlington, VA). *Energy Technology (Washington, D.C.);* **9**: 142-153(Jun 1982). (CONF-820217—). Contract AC02-76CS22799.

From 9. energy technology conference; Washington, DC, USA (16 Feb 1982).

The property management industry wants to be on the frontier of energy management programs. A program instituted by Charles E. Smith Management company is outlined in this paper. A standard of 65000 BTU's of energy per square foot per year is established as a guideline to measure energy use. Energy use patterns are determined in commercial and residential buildings (pie diagrams are given). The Utility Trend and Analysis Chart was established to keep a historic record of use. A detailed energy audit was performed, in which the energy auditor performs a late-night walk through to determine base load. A list of various conservation opportunities is drawn up. The list is then prioritized, economic justifications arrived at by payback method, net present value method, or internal rate of return method. Implementation of cost effective measures means keeping up with the latest technology. Building science, the study of thermal characteristics of building materials, is employed. A helicopter survey utilizing thermographic equipment was made of major complexes to show heat loss on videotape. A central computer system was installed to monitor usage twenty four hours a day.

7778 **Commercial building design and energy conservation: a preliminary assessment.** Nieves, A.L.; Rosoff, D. (Battelle, Pacific Northwest Laboratories). *Energy Technology (Washington, D.C.);* **9**: 206-216(Jun 1982). (CONF-820217—).

From 9. energy technology conference; Washington, DC, USA (16 Feb 1982).

In 1980 Battelle Pacific Northwest Lab was charged by the DOE to assess change in commercial building design related to energy conservation. Actual quality take-offs (measurements of building components from construction drawings designed by architectural firms) were performed. These were then compared to earlier Baseline study take-offs. Six broad categories were studied: glass in windows and walls, exterior walls, roof systems, roof insulation, heating plant, and lighting. It was found that the amount of glass area has declined; and of current glass more reflective and insulating glass is used. The U-values (insulating values) of walls have increased only minimally. Roof insulation types have proliferated. A lower level of designed connected load for lighting was found in the current sample. Several additional conservation measures were found in isolated cases. In conclusion, though some gains have been made, the potential of available technology is not being realized.

7779 **Energy savings through effective lighting control.** Peterson, D.; Rubinstein, F. (General Electric Co., Warwick, RI 02886). *Energy Technology (Washington, D.C.);* **9**: 359-368(Jun 1982). (CONF-820217—). Contract AC03-76SF00098.

From 9. energy technology conference; Washington, DC, USA (16 Feb 1982).

Commercial lighting control is an area where the potential for major energy savings exists. Tests were designed to demonstrate which control strategies have the greatest impact: economic trade-offs between control cost and savings potential, acceptability of controls to occupants, or control reliability. Relay (on/off or stepped) controls were evaluated at the 58th floor of the World Trade Center. A series of one-to-two-week tests focused on finding

the most effective ways to schedule lighting levels, to match a task, allow for daylighting, and provide occupancybased controls. Activity plots in each test were compared with conventional systems. The results indicate that lighting control can effect consumption positively; relay-based daylighting control is acceptable to occupants, the payback on relay is attractive, and shows high reliability.

3203 Industry And Agriculture

REFER ALSO TO CITATION(S) 7279, 7430, 7681, 7752, 7753, 7797, 7799, 7811, 7828, 7834

7780 **(ANL—83-81) Plastic heat exchangers for waste heat recovery. Final report.** Roach, P.D.; Holtz, R.E. (Argonne National Lab., IL (USA)). Sep 1983. Contract W-31-109-ENG-38. 33p. NTIS, PC A03/MF A01. Order Number DE84004192.

Metallic corrosion is one of the major impediments to using the large amounts of heat available in flue and exhaust gases. Our approach is to develop plastic coatings to eliminate this corrosion problem and make this waste heat available economically. The advantages of plastics and their limitations in this application are discussed. Laboratory testing in an acid-condensing environment has been performed on numerous plastics and has identified several plastics with good potential as corrosion barriers. Polyphenylene sulfide, in particular, has resisted sulfuric acid attack for over 5000 hours and can be used at temperatures up to 300°C.

7781 **(BMFT-FB-T—83-173) Cycle of waste heat energy transformation.** Bohrmann, H.; Eynatten, C. von; Krause, R.; Rudolph, W.; Gneuss, G.; Groesche, F. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Aug 1983. 78p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84750048.

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There is a world-wide interest in the transformation of industrial waste heat with temperatures up to 300°C into mechanical or electrical energy by using ORC-technique. The actual activities deal with the working fluids as well as with the plant components. The main points of the presented research are practical experience with operating plants including behavior of the working fluid and optimizing of plant components. For this reason a pilot plant and a prototype plant have been projected and installed under industrial operating conditions. The working fluid is a R 11-type, Kaltron 11, the expansion machine is a piston-type steam engine. The results of the pilot plant (generated power 30 kW) were used for planning and building the prototype. The prototype plant (elt. power 120 kW) meets the expectation. With this plant an additional power-heat-coupling is practised. The future rise of the energy cost will probably cause an economic industrial application of ORC-plants.

7782 **(CONF-8310206—2) Stabilization of high-COD industrial wastes by two-phase anaerobic digestion to maximize net energy production.** Ghosh, S.; Henry, M.P.; Tarman, P.B.; DeProost, V.H.; Pipyn, P.; Ombregt, J.P. (Institute of Gas Technology, Chicago, IL (USA); Studiebureau O. DeKoninckx, Antwerp (Belgium)). Oct 1983. 10p. IGT, 3424 South State St., Chicago, IL 60616.

From Water Pollution Control Federation annual conference; Atlanta, GA, USA (2 Oct 1983).

Data are presented to illustrate the potential problems in applying conventional high-rate anaerobic digestion to treat high-COD industrial wastes, and to show how an advanced digestion process, two-phase anaerobic digestion, can provide superior performance in terms of waste stabilization efficiency and net energy recovery. The application and advantages of a two-phase digestion configuration, the ANTHANE-ANODEK Process, on several types of industrial wastes are presented; the results of bench-, pilot-, and full-scale plant operations are discussed.

7783 **(DOE/CS/40180—T6) Automation of a gated-pipe irrigation system. Final report.** Manges, H.L.; Blume, H.R.; Matteson, D.K.; Butler, K.G. (Kansas State Univ., Manhattan (USA). Dept. of Agricultural Engineering). Mar 1981. Contract AC01-78CS40180. 52p. NTIS, PC A04/MF A01. Order Number DE84003869.

An existing gated-pipe system was automated by controlling flow into short segments of gated pipe with flow-control valves. Irrigation controllers and a microcomputer both operated the flow-control valves automatically by radio controls. The irrigation controllers and the microcomputer successfully operated the system. Although both can provide cutback-head irrigation, the microcomputer is capable of more flexible system operation. Radio controls sold for controlling model airplanes did not give reliable service when operated continuously in an irrigated field. Operation of the flo-control valves was satisfactory.

7784 **(DOE/CS/40192—T1) Start-up guidelines for the independent remanufacturer.** Lund, R.T.; Skeels, F.D. (Massachusetts Inst. of Tech., Cambridge (USA). Center for Policy Alternatives). Mar 1983. Contract AT01-79CS40192. 167p. NTIS, PC A08/MF A01. Order Number DE83016624.

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Remanufacturing is an industrial process in which worn-out products called cores are restored to like-new condition. In a typical remanufacturing process, identical cores are grouped into production batches, completely disassembled, and thoroughly cleaned. Component parts are replaced or refurbished as necessary to bring their performance at least back to the level of the product when new. The product is assembled, finished, tested, packaged, and distributed in the same manner as new products. Even the warranty on a remanufactured product is usually similar or identical to the OEM new product warranty. Marketing, technology, economics, legal considerations, and organizational aspects of remanufacturing are discussed.

7785 **(DOE/CS/40192—T2) Guidelines for an original equipment manufacturer starting a remanufacturing operation.** Lund, R.T.; Skeels, F.D. (Massachusetts Inst. of Tech., Cambridge (USA). Center for Policy Alternatives). Jul 1983. Contract AT01-79CS40192. 172p. NTIS, PC A08/MF A01. Order Number DE83016625.

Remanufacturing is an industrial process in which worn-out products (called cores) are restored to like-new condition. In a typical remanufacturing process, identical cores are grouped into production batches, completely disassembled, and thoroughly cleaned. Component parts are replaced or refurbished as necessary to bring their performance at least back to the level of the product when new. The product is assembled, finished, tested, packaged, and distributed in the same manner as new products. Even the warranty on the remanufactured product is usually similar or identical to the OEM new product warranty. Marketing, distribution, collection, technology, economics, organizational aspects, and legal considerations of remanufacturing are discussed.

7786 **(EGG-SE—6451) Available energy method for evaluating thermodynamic performance of heat pump systems.** Bliem, C.J. Jr.; Demuth, O.J.; Richlen, S.L. (EG and G Idaho, Inc., Idaho Falls (USA)). Nov 1983. Contract AC07-76ID01570. 71p. NTIS, PC A04/MF A01. Order Number DE84005188.

An available-energy-efficiency method, based on the Second Law of Thermodynamics, is developed for the evaluation and comparison of the thermodynamic performance of different types of heat pump systems. Defficiencies and limitations of the more commonly used performance indicators, coefficient of performance and fraction of Carnot cycle coefficient of performance, are discussed. Finally, several heat pumps of different types and in various stages of development are evaluated and compared in terms of available-energy efficiency as examples of the application of the method.

7787 **(NLH/IJ/M—122) Energy use efficiency as a measure of the effect of production factors in agriculture.** Njoes, A. (Norges Landbrukshoegskole, Aas. Inst. for Jordkultur). 1981. 15p. (In Norwegian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750119.

The report deals with fertilizer aspects of the efficiency of energy use in agricultural production. A output/input ration is defined and used in calculation examples. Esub(f) (the partial energy efficiency for a factor F) as a continuous function would be the

partial derivative of the yield response function with respect to F. The magnitude of the constants will depend on the use of the product and production method. From an energy efficiency point of view esub(f) = 1.0 would indicate an optimal quantity of the factor F. The formula has been used on research results with nitrogen fertilizer trials in grain crops, potatoes and grass for silage. At moderate quantities of F, the parameter esub(f) has been considerably larger than 1.0. For Norwegian price relations in 1981 the energy optimum in small grain is found at a slightly lower F application than the economic optimum. In potatoes and grass silage the partial energy efficiency showed similar trends as in grain crops, generally high esub(f) values for the first fertilizer increments, then decreasing towards 1.0 and below 1.0 at very high amounts. It was also shown that high esub(f) values may be obtained with moderate irrigation water application in small grain. In rainfed small grain crops the esub(f) = 1.0 was found at 140 kg N/ha in a year with sufficient water, and at 70 kg N/ha in a dry year. This indicates that future utilization of total resources would be best served with simultaneous control of both the N and the water factor. Finally, early sowing of small grain gave a much higher esub(f) value for N-application quantity than late sowing. In Norway the use of N-fertilizer contributed roughly one percent of the country's total use of energy in 1979. 10 tables, 2 drawings.

7788 **(NP—3770155) Theoretical investigation of a recuperator-gas turbine process as a possibility for energy saving.** Cerbe, G. (Technische Univ. Clausthal, Clausthal-Zellerfeld (Germany, F.R.). Fakultaet fuer Bergbau, Huettenwesen und Maschinenwesen). 10 Feb 1982. 152p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE83770155.

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Considerable energy savings are possible by combining gas turbines with other processes. In power plants, combined gas/steam turbine processes are quite frequent. This is not the case with metallurgical works. In the present study, an open gas turbine has been combined with a blast furnace recuperator; the recuperator is assumed to be the given system. The author intended to determine fuel savings resulting from the combined process and the energy demand of the conversion process. As far as possible, blast furnace gas should be used. Natural gas or coke oven gas should only be used if the desired operating parameters cannot be reached otherwise.

7789 **(NP—3770176) Tables to determine the heat consumption by greenhouses in the Munich/Weihenstephan region.** Damrath, J. (Hannover Univ. (Germany, F.R.). Inst. fuer Technik in Gartenbau und Landwirtschaft). 1981. 150p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE83770176.

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Due to the continiuing use in the primary energy costs, the deliberations concerning the reduction of heating costs in horticultural enterprises gains more importance. Calculations with various energy saving measures are being carried out. In many cases, however, there is no appropriate data on the heating energy needed in several sorts of greenhouses, on internal temperatures, and directions of the building are available. This booklet contains tables with data for the location of Weihenstephan near Munich. This location seems more appropriate than the big city of Munich due to its rural structure and the fact that horticultural enterprises are mostly located outside of big cities. The values listed can also be applied for the neighhbouring communities. A corresponding collection of tables can be obtained for the climate of Hannover.

7790 **(NP—3770177) Input-output technology assumptions and the energy requirements of commodities.** Flaschel, P. (Freie Univ. Berlin (Germany, F.R.). Inst. fuer Quantitative Oekonomik und Statistik). 1982. 56p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE83770177.

The considerations evidently have to precede any treatment of the possible disturbances caused by the lack of information and by the aggregation that may be involved in the data finally employed for measurement. To supply the general foundations for such a measurement consequently is the main purpose of the analysis that follows. After some preliminaries which will make standard input-output methodology accessible for the questions to be approached, first the concept of 'energy consumption' and some of its properties is considered. A similar contribution is made with regard to the concept of 'energy costs'. A brief comparison of these two concepts is given accompanied by an examination of the applicability of the second one for the study of technological change.

7791 **(NP—3770179) How energy-conscious is the Swiss industry.** (Energieforum Schweiz, Bern (Switzerland)). Mar 1982. 51p. (In German). NTIS (US Sales Only), PC AX04/MF A01. Order Number DE83770179.

As the end of 1981 the 'Energieforum Schweiz', in co-operation with the 'Schweizerischer Energie-Konsumenten-Verband von Industrie und Wirtschaft' (EKV) and the 'Schweizerische Aktion Gemeinsinn fuer Energiesparen' (SAGES), conducted an inquiry among businesses of industry, trade and the service sector. Its aim was to establish in how far thought is given in Swiss private economy to questions of energy and has much has already been done in the way of practical measures of energy policy. The investigation had the support of the board of directors of the 'Schweizerischer Handels- und Industrieverein' and the cantonal chambers of commerce.

7792 **(ORAU/IEA—83-10(M)) Results of the Oak Ridge industrial model.** Reister, D.B. (Oak Ridge Associated Universities, Inc., TN (USA)). Oct 1983. Contract AC05-76OR00033. 19p. NTIS, PC A02/MF A01. Order Number DE84004063.

The Oak Ridge Industrial Model (ORIM) was developed in 1979 for the Energy Information Administration (EIA). ORIM forecasts the demand for six major fuels by nine industrial sectors in ten regions of the US. Several major modifications to ORIM are described: (1) the solution period was changed from quinquennial to annual; (2) 1979 EIA data were used as the benchmark for the model; and (3) a lag was added to the fuel share function. After the modifications, the ORIM forecasts energy demand beginning in 1970. The price elasticity forecasts are reasonable. The ORIM backcast agrees well with historical data for electricity and coal. The results are not satisfactory for fuel oil; however, two independent data sources give quite different sets of values for the historical data. Before the model can be improved further, the data base must be improved.

7793 **(PNL-SA—11300) Effective transfer of industrial energy conservation technologies.** Clement, M.; Vallario, R.W. (Pacific Northwest Lab., Richland, WA (USA)). Apr 1983. Contract AC06-76RL01830. 12p. (CONF-830495—2). NTIS, PC A02/MF A01. Order Number DE84004832.

From 5. annual industrial energy conservation technology conference; Houston, TX, USA (17 Apr 1983).

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Voluntary participation in industrial energy conservation programs resulted in savings of approximately 1 million barrels of oil equivalent per day in the US during 1981. These energy savings accrued largely from the development, introduction, and acceptance by industry of new energy conserving technologies. These new technologies were developed through cost sharing programs between the Department of Energy and private industry. These joint efforts reduced risk to industry, thus making them willing to accept and use these new technologies at an accelerated rate. Examples of several technologies that were used by industry at an accelerated rate are described. These technologies are: textile foam finishing and dyeing, forging furnace modifications, and high-efficiency metallic recuperators.

7794 **(STF—15A82006) Heating and cooling curves for thermodynamic processes in industry. Illustration: Crude oil distillation.** Loeken, P.A. (SINTEF, Trondheim (Norway)). Feb 1982. 15p. (In Norwegian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750121.

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A method for calculation of the heating and cooling curves for a thermodynamic industrial process is described. As an illustration of an application the distillation of crude oil in a refinery has been used. These considerations lead to investigation of the minimum energy consumption which turns out to be half of the energy used today. 5 drawings, 4 tables.

7795 **Effect of H_2/CO ratio on energy consumption in ironmaking.** Berrun, J.; Viramontes, R. (Hyl - Iron And Steel Technology). *Energy Technology (Washington, D.C.);* 9: 320-328(Jun 1982). (CONF-820217—).

From 9. energy technology conference; Washington, DC, USA (16 Feb 1982).

Direct reduction is defined as a process in which metallic iron is produced by a reduction of iron ore at a temperature below melting point of the materials involved. Refining gas must be converted into various mixtures of carbon monoxide and hydrogen. This paper studies the effect of different reducing gas compositions on reduction, and suggests modifications and economic tradeoffs. The composition of the reducing gas depends on the type of process utilized. A computer simulation of various reductions is made. The results indicate that the total energy requirement is inversely proportional to the H_2/CO ratio. In other words, high temperature and high H_2/CO ratio are associated with the lowest energy consumption, and lowest capital costs.

3206 Municipalities And Community Systems

REFER ALSO TO CITATION(S) 7172, 7377, 7463, 7464, 7760, 7760, 7784, 7785

7796 **(ANL/CNSV-TM—122) Biochemical conversion of municipal solid waste: a technology status report.** Pfeffer, J.; Isaacson, R. (Illinois Univ., Urbana (USA)). Dec 1982. Contract W-31-109-ENG-38. 74p. NTIS, PC A04/MF A01. Order Number DE84004251.

System description and background and research and development needs are presented for conventional anaerobic digestion, unconventional anaerobic digestion, ethanol production, and alkane/chemical-feedstock production. The operating status of the RefCom System in Pompano Beach, Florida is described. (MHR)

7797 **(ANL/CNSV-TM—123) Institutional issues concerning energy from municipal waste: a status report.** Ridzon, G.J.; Blum, S.L.; White, A.L.; Pearson, C.V. (Argonne National Lab., IL (USA)). Jun 1983. Contract W-31-109-ENG-38. 63p. NTIS, PC A04/MF A01. Order Number DE84004254.

The institutional issues affecting the successful recovery of energy and material from municipal solid wastes (MSW) are described. These topics include economics, markets, financing, risks, contracts, environmental impacts, and operation.

7798 **(BMFT-FB-T—83-158) Investigations to diminish the heavy metal concentrations in sewage sludges with organic complexing reagents.** Gutekunst, B.; Hahn, H.H. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Aug 1983. 39p. (In German). NTIS (US Sales Only), PC A03/F A01. Order Number DE84750044.

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The disposal of sewage sludge in agriculture is frequently impossible due to its high heavy metal content. One possibility of reducing the heavy metal content of sludges is to dissolve them by complexation with chelates and to remove the metal complexes by dewatering the sludge. As complexing reagents EDTA, NTA, DTPE and di-Sodiumtartrate were used at different conditions (variation of chelate concentration, pH and reaction time). The concentrations of cadmium, chromium, copper and nickel in the sludge residues could be reduced significantly under laboratory conditions if the appropriate chemical settings were obeyed.

7799 **(CONF-8206221—) Anaerobic treatment of wastewater in fixed film reactors. Preprints of papers.** (Danmarks Tekniske Hoejskole, Lyngby). [nd]. 439p. NTIS (US Sales Only), PC A19/MF A01. Order Number DE84770001.

From IAWPR specialised seminar; Copenhagen, Denmark (16 Jun 1982).

Separate abstracts were prepared for individual papers.

7800 **(CONF-8210227—Summs.) District heating and cooling assessment program. Final review conference.** (Department of Housing and Urban Development, Washington, DC (USA)). Oct 1982. Contract AI01-81CS24362. 63p. NTIS, PC A04/MF A01. Order Number DE84004717.

From HUD/DOE district heating and cooling assessment program conference; St. Paul, MN, USA (26 Oct 1982).

Short summaries are given of speeches and panel discussions covering such topics as: marketing, financing, cogeneration, utility role, and energy from refuse. (MHR)

7801 **(DOE/CS/24362—T2) District heating and cooling for Atlanta. Preliminary assessment. Final report.** (Atlanta Office of Budget, Audit and Management, GA (USA); Resource Development Associates, Marietta, GA (USA)). Aug 1982. Contract AI01-81CS24362. 254p. NTIS, PC A12/MF A01. Order Number DE84004699.

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Three basic steps were carried out: the identification and quantification of thermal loads on a city-wide basis; identification and characterization of existing and potential thermal supply sources; and configuration of Early-Start district heating projects based on spatial location and distribution of thermal loads and thermal sources. The technical and economic feasibility, institutional and legal aspects, and action plan are discussed. (MHR)

7802 **(DOE/CS/24362—T3) Campbellsville, Kentucky: South Campbellsville Neighborhood Redevelopment Project Area, district heating and cooling feasibility study. Final report.** (Department of Housing and Urban Development, Washington, DC (USA)). Sep 1982. Contract AI01-81CS24362. 24p. NTIS, PC A02/MF A01. Order Number DE84004698.

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This feasibility study focuses on locally available energy resources in terms of natural gas, coal, and ground water. No clear feasibility for a DHC system was found in the absence of any existing waste heat source and the need to secure a major consumer to justify the capital cost of a coal fired boiler. (MHR)

7803 **(DOE/CS/24362—T4) Missoula, Montana district heating/cooling assessment. Final report.** (Missoula Planning Office, MT (USA)). Sep 1982. Contract AI01-81CS24362. 97p. NTIS, PC A05/MF A01. Order Number DE84004697.

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Some background information about district heating in general is presented, as well as an assessment of the feasibility of using coal as a potential fuel source. The town's heat load, heat sources, and environmental considerations are reviewed. The impact on the Community Development Block Grant activities and the institutional issues are presented. (MHR)

7804 **(DOE/CS/24362—T5) District heating and cooling: feasibility study, City of Cambridge.** (Pequod Associates, Inc., Boston, MA (USA); Energy Design Team, Inc., Boston, MA (USA); Timmerman (Robert W.) and Associates, Boston, MA (USA)). Jul 1982. Contract AI01-81CS24362. 173p. NTIS, PC A08/MF A01. Order Number DE84004713.

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The initial task of the project was to gather library and reference materials. The team evaluated existing heat sources and heat requirements. The next step was to assess the economic and technical feasibility of alternative DHC projects from economic, environmental, employment, conservation, and community development objective perspectives. Institutional factors were assessed, including ownership, financing, and regulatory attitudes. This report is divided into six distinct segments. They are: Conclusions and Recommendations, Background, Methodology, Findings, and a brief Implementation Plan.

7805 **(DOE/CS/24362—T6) Assessment of district heating/cooling potential in Holland, Michigan. Final report.** (Smith-Hinchman and Grylls Associates, Inc., Detroit, MI (USA); Cummins and Barnard, Inc., Ann Arbor, MI (USA)). Jul 1982. Contract AI01-81CS24362. 130p. NTIS, PC A07/MF A01. Order Number DE84004715.

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A study undertaken to evaluate the potential for district heating/cooling (DHC) in the City of Holland, Michigan is documented. The purpose of the study was to assess the concept of delivering energy from a centralized source (or several sources) through a piping network to many end users for heating domestic hot water, space heating, space cooling and industrial process use. The Holland community was involved through representation of various businesses, agencies and community groups as part of an Assessment Work Group (AWG) membership. The AWG worked throughout the study with the BPW staff and consultants. Conclusions and recommendations of the study reflect the joint effort.

7806 **(DOE/CS/24362—T7) District heating/cooling assessment for Richmond, Indiana. Final report.** (Resource Development Associates, Inc., Dayton, OH (USA)). 14 Sep 1982. Contract AI01-81CS24362. 206p. NTIS, PC A10/MF A01. Order Number DE84004716.

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The potential for one or more district heating and cooling systems in the City of Richmond was assessed. Appropriate community energy suppliers and users are identified and government policy-makers and private concerns were educated as to the options available. Recommendations were made concerning the most technically and economically sound system alternatives. A time frame was suggested for project construction, ownership, and operating arrangements, and institutional and legal considerations, as well as potential benefits to the City of Richmond were identified. Three early-start projects were identified which have the potential for near-term DHC system development within the city. A plan of action is presented.

7807 **(DOE/CS/24362—T8) Heat sources for district heating for Atlantic City.** (Timmerman (Robert W.) and Associates, Boston, MA (USA)). 6 Jul 1982. Contract AI01-81CS24362. 122p. NTIS, PC A06/MF A01. Order Number DE84004711.

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The results of a study of heat sources for district heating for a proposed district heating system for Atlantic City are presented. Both solid waste incineration and cogeneration were considered in detail. Other sources were very briefly considered and either found not feasible, or more desirable for a second phase of district heating development. In addition, the use of ice piles for district cooling is investigated. The economic analysis is restricted to estimates of capital and operating costs, leaving projections of financing, and detailed economic analysis to others. Capital and operating cost estimates are made for both the present, and for 3 years of 8% inflation. The solid waste portion of the study of the availability of solid waste, as well as consideration of the effect of various refuse heating on the overall economics. The cogeneration study includes consideration of the optimum size and fuel choice for the engines. Capital and operating costs are estimated for both high speed, light oil fired units, and slow speed, heavy oil fired units. The ice pile portion includes consideration of the size of the pile required to produce 5000 tons of cooling for 120 days, and estimates of the capital and operating costs. In addition, consideration is given to use of the waste heat from the engine driven pumps as a heat source for district heating. Ways to use the cold water in a once thru manner are described. Environmental effects are briefly discussed.

7808 **(DOE/CS/24362—T9) Assessment of district heating/cooling potential in Columbus, Ohio. Final report.** (Columbus Dept. of Energy and Telecommunication, OH (USA)). Sep 1982. Contract AI01-81CS24362. 261p. NTIS, PC A12/MF A01. Order Number DE84004608.

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This final project report relates the methodology, pertinent data, technical, economic, institutional and regulatory analyses and results developed over the course of a year-long feasibility assessment study performed by the City of Columbus between September, 1981 and September, 1982. Columbus was one of twenty-eight US cities that entered into cooperative agreements with US HUD and the Department of Energy for the purpose of assessing district heating/cooling potential in Community Development Block Grant-eligible communities. After describing the process and information employed in the Columbus assessment, conclusions are drawn pertaining to the apparent future of district heating/cooling in Columbus, and implications of this work for future national policy and local government action are offered.

7809 **(DOE/CS/24362—T11) City of Allentown assessment of a district heating system.** Oliker, I.; Tamayne, T. (Burns and Roe, Inc., Oradell, NJ (USA)). Sep 1982. Contract AI01-81CS24362. 138p. NTIS, PC A07/MF A01. Order Number DE84004710.

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The energy sources selected to accommodate the heat load consist of five 10 MWt units at the high temperature hot water generating station, ten 10 MWt units at the high temperature hot water generating station, and two 25 MWe (37.5 MWt) cogenerating fluidized bed combustion units at the incinerator site. The service area selected consists of the downtown commercial district. Total peak heat load for the forty seven block commercial district and twenty two industrial customers is estimated to be 187 MWt. The following aspects are covered: transmission and distribution piping systems, development strategy, capital costs and construction schedule, operation, economics, environmental analysis, and community impact.

7810 **(DOE/CS/24362—T12) Economic and technical feasibility study of District Heating and Cooling (DH/C).** (Albany, City of, NY (USA)). 15 Sep 1982. Contract AI01-81CS24362. 104p. NTIS, PC A06/MF A01. Order Number DE84004712.

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The investigation and findings of a study undertaken to determine the technical and economic feasibility of applying district heating and cooling technology to Albany, New York are described. Emphasis is placed on the identification of projects suitable for implementation within one to three years. Heat loads for potential service areas are developed from census tract data and matched with the available excess energy at existing heat sources to determine initial feasibility. Projects appearing feasible are examined in detail by developing realistic schemes and cost estimates. Institutional influences are examined, and recommendations are made where needed to overcome hindrances. Ownership and operational options are discussed and recommendations made. One project is recommended for early implementation: extension of a district heating project determined feasible by an earlier study and expected to be operational in Fall 1983. It is concluded that two projects may be feasible at some future date. One is a new co-generation plant and distribution system to service a large grouping of institutional buildings. The other is a proposed central business district project that includes restoration of an historical train station and construction of nearby high-rise hotel and office towers.

7811 **(DOE/CS/24362—T13) Solid waste energy recovery project, Galax, Virginia: feasibility analysis.** (Dewberry and Davis, Marion, VA (USA)). Sep 1982. Contract AI01-81CS24362. 50p. NTIS, PC A03/MF A01. Order Number DE84004706.

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It is concluded that an energy-from-solid-waste system can be built and operate in compliance with all existing applicable state air, water, and health regulations, and heat energy can be sold at an economically feasible price. The high capital cost of steam distribution piping and the distances between the potential consumers preclude, at least initially, the feasibility of serving more than one consumer. There is at present only one customer who has a sufficiently large demand for heat energy and whose costs for this energy are great enough to make the purchase of energy from the waste burning facility attractive. Therefore, it is recommended that: (1) the energy recovery incinerator plant should be located on the customer's property. (2) Only solid waste from the City of Galax would be used since the amount will closely match that required to adequately serve Hanes without excess. The City of Galax landfill

should remain open to receive the ash residue and nonburnables from the plant.

7812 **(DOE/CS/24362—T14) City of Baltimore district heating assessment. Final report.** (Resource Development Associates, Marietta, GA (USA)). Sep 1982. Contract AI01-81CS24362. 200p. NTIS, PC A09/MF A01. Order Number DE84004714.

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The following are discussed: Cherry Hill District Heating Project, Hopkins/East Baltimore District Heating Project, institutional assessment, community impacts, environmental evaluation, conclusions and recommendations, and action plan.

7813 **(DOE/CS/24362—T16) City of New York preparing of a district heating and cooling systems Project (Phase II).** (New York City Energy Office (USA)). 27 Aug 1982. Contract AI01-81CS24362. 136p. NTIS, PC A07/MF A01. Order Number DE84004607.

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The project with the greatest, and most immediate potential, is the Brooklyn Navy Yard Complex, which included the Brooklyn Navy Yard Industrial Complex, nearby public housing apartments, Brooklyn Hospital, Cumberland Hospital, the Red Hook Sewage Treatment Plant and Pratt Institute. Initial engineering investigation indicates that five, and probably six, of the 160,000 lb/hr, 500 psi boilers in the generating plant at the Navy Yard can be economically refurbished, and could produce up to 900,000 lbs/hr of steam. Further, at least two of the on site turbines appear to be refurbishable, making possible cogeneration of electricity with district heating and/or cooling. The NYCEO research has shown that an innovative system, using presurized hot water and heat exchangers (to generate low pressure steam for individual apartment houses) is an effective means to satisfy the heating requirements of New York City's apartment buildings, many of which are already steam heated, while reducing their energy costs and oil consumption. This approach takes advantage of a modern hot water system, while avoiding the disadvantage of expensive building retrofit. Preliminary studies have shown that thermal energy costs to Yard tenants, among the highest anywhere in the USA, will be reduced. These savings will increase long term tenant occupancy as well as ability to create and hold jobs in the area.

7814 **(DOE/CS/24362—T17) Assessment of district heating/cooling potential for the Frenchman's Cove redevelopment project. Final report.** (Smith-Hinchman and Grylls Associates, Inc., Detroit, MI (USA); Cummins and Barnard, Inc., Ann Arbor, MI (USA)). Oct 1982. Contract AI01-81CS24362. 179p. NTIS, PC A09/MF A01. Order Number DE84004696.

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A study undertaken to evaluate the potential for district heating/cooling (DHC) in the City of Ecorse, Michigan is documented. the purpose of the study was to assess the concept of delivering energy from a centralized source (or several sources) through a piping network to many end users for heating domestic (tap) hot water, space heating, and space cooling. The primary focus of the study was the proposed redevelopment of eighty acres in Ecorse along the Detroit River waterfront known as Frenchman's Cove. As planned, the complete development would place nearly 2 million square feet of new, mixed use structures/facilities on the site and an eighteen acre undeveloped island located 300 feet offshore. Other areas of the city were also examined to identify and evaluate existing supply and end use possibilities. In addition, several neighboring communities were examined to determine the feasibility of downriver DHC network. Six large thermal energy producers identified in the study area include the Detroit Edison River Rouge power plant (DECo.-RR), the Wyandotte Municipal Services Commission (WMSC) power plant, a BASF/Wyandotte Corporation plant, a Marathon Oil refinery, the Great Lakes Steel complex, and the E.C. Levy Company slag processing site. Each was examined for potential as a thermal supplier on a district heating network.

7815 **(DOE/CS/24362—T18) Santa Ana Pueblo assessment of district heating and cooling. Final report.** (Santa Ana Pueblo, Bernalillo, NM (USA); Western Energy Planners Ltd., Aurora, CO (USA); Western Energy Planners Ltd., Albuquerque, NM (USA)). Jul 1982. Contract AI01-81CS24362. 358p. NTIS, PC A16/MF A01. Order Number DE84004606.

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The evaluation covered six major tasks of technical, financial, environmental and cultural considerations of several heat sources including: traditional Indian bread ovens; community solid waste disposal; cogeneration and electric power plant; active solar collectors with fresh water pond storage; salt gradient ponds, both gel and free standing; heat pumps; geothermal - both hot dry rock and hydrothermal sources; and biomass resources for methane production.

7816 **(DOE/CS/28064—T1) Sludge incinerator.** Hudnut, W.H. III; Hoppock, D.W. (Indianapolis Center for Advanced Research, IN (USA)). [nd]. Contract FC01-75CS28064. 58p. NTIS, PC A04/MF A01. Order Number DE84003868.

This demonstration project involved the following major activities: incinerator operational analysis; complete instrumentation of one incinerator to measure (a) excess air, (b) internal incinerator temperatures at the various hearth levels, as well as sludge and wall temperatures, (c) pressure, temperature and flow rates of all incinerator supply air sources and exhaust air locations, (d) total and burner-specific fuel flow rates, (e) exhaust gas composition and (f) sludge cake flow rate; parametric incinerator tests to determine the effect of the main incinerator operational variables on fuel consumption and to define an improved operating mode; and a 3-1/2 day operational test of the improved operating mode to demonstrate the feasibility of reducing incinerator fuel consumption. The testing program included the collection of thirty-three sets of parametric data. An improved operating mode was then defined from an analysis of the parametric test data and other operational requirements.

7817 **(NP—4750087) Research project concerning computerized monitoring, regulation and control of energy. Pt. 1. Survey of energy-saving fields.** (Energiministeriet, Copenhagen (Denmark)). [nd]. 104p. (In Danish). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84750087.

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In 1981 the district heating covered 33% of the total heat consumption in Denmark. Technological institutions in collaboration with the Ministry of Energy have prepared a catalogue surveying the known methods and proposing new ones for computerized control of district heating systems. Energy conservation achieved by means of improved control can result in 10-20% of the present consumption.

7818 **(NP—4750088) Research project concerning computerized monitoring, regulation and control of energy. Pt. 2. Computer-based system solution.** (Energiministeriet, Copenhagen (Denmark)). [nd]. 155p. (In Danish). NTIS (US Sales Only), PC A08/MF A01. Order Number DE84750088.

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In connection with computer evaluation for district heating purposes there is given a description of microprocessors available or utilized in central heating plants. Various heat distribution networks, boiler centers and air-condition centers are discussed and microcomputer control for major and minor heat consumers is proposed. Meteorological conditions are incorporated into the control program and updating every 6th hour will result in energy conservation.

7819 **(NP—4750089) Research project concerning computerized monitoring, regulation and control of energy. Conclusion, summary and proposal of demonstration project.** (Energiministeriet, Copenhagen (Denmark)). [nd]. 59p. (In Danish). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84750089.

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The primary investigation of energy control systems to be developed in the typical municipal consumer areas has resulted in two major statements: With optimized control the energy consumption in any kind of district heating can be reduced by 10-20%. Computer-based systems give technical possibilities for optimum control and regulation achievement. Computer development allows to coordinate the following problems connected with district heating control: regulation of combustion process in a heating centre, temperature control in the distribution network, heating and ventilation systems, breaker energy systems in larger buildings, apartments and detached villas. A computerized control system is operator-independent, maintenance and its cost is easier to handle, and the same system can be used in other municipal tasks such as control of sanitary network, security arrangements etc. Demonstration project is adviseable in order to verify the calculated energy savings, primarily on municipal level, financed by the Danish Ministry of Energy. The project will cover some 8000 apartments heating center with one central computerized control unit.

7820 **(PB—83-244640) Osaka and its technology, Number 2, 1982.** (Osaka Municipal Urban Engineering Information Center (Japan)). 1982. 61p. NTIS, PC E04/MF E01.

The Osaka Municipal Urban Engineering Information Center was established in 1982 with the objective to collect, classify and exchange theses and technical information on urban engineering and technology for reference and to extend expert advice and cooperation in the execution of various engineering projects of local governments at home and abroad. This issue contains the following articles: Bridges in port area of Osaka City; Circumstances of water use and water-saving measures; Halophilic Bdellovibrio and bacterial predators distributed in estuarine environments; Studies on treatment of waste water from office buildings and sludge in water works; A study of energy conservation-oriented buildings; and Soil engineering studies on the banking construction of Tsurumi Park.

7821 **(PB—83-244657) Osaka and its technology, Number 3, 1983.** (Osaka Municipal Urban Engineering Information Center (Japan)). 1983. 73p. NTIS, PC E04/MF E01.

The Osaka Municipal Urban Engineering Information Center was established in 1982 with the objective to collect, classify and exchange theses and technical information on urban engineering and technology. This issue contains the following articles: Urban Development Strategy for Osaka City; Construction of Abeno Station on the Tanimachi Line of Osaka Municipal Subway Using the Shield Method; Construction of Tennoji-Benten Trunk Sewer; SILB Process- A new Method for the Solidification Treatment of Sludge; Studies on Deodorization by Activated Sludge; Estimation of Long-Term Average Concentration of NO sub 2 in Areas Adjacent to Trunk Roads; Development of a Soil Waste Recycling Plant and its System; and Upright Wave-dissipation Caisoon-Type Breakwaters and Dikes.

7822 **(PB—83-244913) Program documentation for the Resource Recovery Planning Model.** Berman, E.B.; Chapman, R.E.; Hung, H.K. (National Bureau of Standards, Washington, DC (USA). Center for Building Technology). May 1983. 144p. (NBSIR—83-2745). NTIS, PC A07/MF A01.

The Resource Recovery Planning (RRPLAN) model is designed with three purposes in mind. First and foremost, is the ability to generate a preferred (optimal) plan for resource recovery. Second, is the capability to evaluate a scenario specified by the decision maker for technical and economic feasibility. Third, is its use as a tool to facilitate the decision making process by providing answers to many what-if questions through an in-depth sensitivity analysis. In order to find the optimal solution, however, it is necessary to address three interdependent issues. The first two issues are concerned with the siting and sizing of solid waste management facilities, whereas the third concerns how to allocate commodities among the various facilities and potential markets. The model is written in FORTRAN and complies with the American National Standards Institute X3.9-1978 standard for that language.

7823 **(PB—83-247023) District heating/cooling feasibility study for Jamestown, New York.** Oliker, I.; Buffa, W.; Harms, R.; Preston, E. (Burns and Roe, Inc., Oradell, NJ (USA)). Dec 1982. 162p. NTIS, PC A08/MF A01.

The report describes the results of a district heating feasibility study for Jamestown, New York based on the use of a power plant located within the city limits. Several options for the extraction of heat from the power plant were developed, with heat balances presented, based on the development of a hot water district heating system. The geography and climate of the area are discussed, as well as the primary potential heat district. The heat load assessment was based on fuel consumption data collected from a sampling of various types of structures and operations. The report presents the methodology in detail, along with block-by-block results including heated floor space, total annual fuel consumed, and peak heat rate demands. A transmission and distribution system was then developed for delivering heat from the power plant to the district heating customers.

3209 Education And Public Relations

REFER ALSO TO CITATION(S) 7767

7824 **(DOE/CS/20423—T1) Energy management and community planning. Final technical narrative report.** (American Planning Association, Chicago, IL). 2 Aug 1982. Contract FG01-78CS20423. 4p. NTIS PC A02/MF A01. Order Number DE84004964.

The objective was to establish systematic means of technology transfer and information exchange to incorporate specific considerations of energy management in public planning decisions. The means used included publications, conferences, workshops, and technical advice. These activities are listed. (MHR)

33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS

3301 Internal Combustion Engines

REFER ALSO TO CITATION(S) 7834

7825 **(CONF-8310183—3) Ceramic coatings for heat engine materials - status and future needs.** Lackey, W.J.; Stinton, D.P.; Cerny, G.A.; Fehrenbacher, L.L.; Schaffhauser, A.C. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 15p. NTIS, PC A02/MF A01. Order Number DE84003401.

From International symposium on ceramic components for engines; Hakone, Japan (17 Oct 1983).

The current status and future potential for application of ceramic coatings to diesel and turbine engine components were assessed. Properties were tabulated for numerous materials from the oxide, carbide, nitride, and boride families. Promising new deposition methods and in-situ gas and solid phase characterization techniques are identified. Emphasis was placed on zirconia thermal barrier coatings, but coatings for reducing wear, erosion, and friction were also addressed. The use of coatings will expand in the future and permit higher performance and more reliable heat engines.

7826 **(DOE/CS/50286—4) Water and alcohol use in automotive diesel engines. Alternative Fuels Utilization Program.** Donnelly, J.J. Jr.; White, H.M. (Aerospace Corp., El Segundo, CA (USA). Energy Conservation Directorate). Sep 1983. Contract AI01-82CS50286. 189p. NTIS, PC A09/MF A01. Order Number DE84004196.

A review has been made of the current technology of water and alcohol use in automotive diesel engines. Emphasis has been placed on assessing engine test results for seven methods of using alcohols as supplements or complete replacements for petroleum-based diesel fuel. The methods investigated include the dual-fuel techniques of emulsification, blending, fumigation, and dual-injection, and the monofuel techniques of cetane number improvement, spark ignition, and ignition by electrically heated surfaces or glow

plugs. With the exceptions of alcohol/diesel fuel blends and heated surface ignition, all methods have been applied to prototype vehicles and proved successful to some extent in field tests of cars, trucks, buses, or tractors. The changes observed, relative to normal diesel fuel use, in power, fuel consumption, thermal efficiency, and exhaust emissions are documented. Other factors evaluated include diesel fuel displacement by alcohol in specific vehicles and projections of potential domestic fuel savings throughout the transportation sector; fuel cost increases; changes in vehicle system hardware, durability, driveability, and safety; and additional study needs.

7827 **(DOE/RL/01830—T10) Synfuel modified diesel. Final report, March 31, 1981-May 25, 1982.** Kamo, R.; Yamada, T.; Nakagaki, T. (Cummins Engine Co., Inc., Columbus, IN (USA); Yanmar Diesel Engine Co. Ltd., Osaka (Japan); Komatsu Ltd., Tokyo (Japan)). 1982. Contract AC06-76RL01830. 140p. NTIS, PC A07/MF A01. Order Number DE84002189.

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The Synfuel Modified Diesel program has yielded several interesting conclusions. The contemporary diesel engine, whether prechamber or direct injection, cannot burn SRC-II fuel without modification. When SRC-II is blended with a 50% or larger amount of standard No. 2 diesel fuel, the prechamber diesel can burn the blend with slight modification to the injection timing. The spark-assisted diesel has shown remarkable improvement in diesel combustion. It can handle blends as well as straight SRC-II during operation. The hot adiabatic direct injection engine has also demonstrated capability in burning SRC-II fuel. However, with the spark-assisted prechamber, or with the adiabatic direct injection engine, cold start is still a problem. Intake manifold heating is suggested for starting. The emissions characteristics measured with SRC-II fuel in the adiabatic diesel and conventional engine were similar. Mutagenicity is lower with SRC-II. The engine performance is quite similar to conventional diesel fuel when corrected for the lower heating value of the SRC-II fuel oil. This report covers the prechamber and the spark-assisted pre-chamber diesel engine by Yanmar Diesel Engine Co. Ltd and Komatsu Ltd respectively. Complementary performance and emissions data with SRC-II and No. 2 diesel fuel in an adiabatic direct injection engine is included in a report due in June 1983.

7828 **(DOE/RL/01830—T13) Development of advanced plasma sprayed ceramic coatings for industrial gas turbine engine. Final report.** Bevan, C.E. (Pratt and Whitney Aircraft, East Hartford, CT (USA). Commercial Products Div.). 1981. Contract AC06-76RL01830. 44p. NTIS, PC A03/MF A01. Order Number DE84002185.

Twenty-eight candidate coating systems were selected from prior experience for their potential erosion/corrosion resistance, and were screened to determine clean fuel cyclic spall resistance. Results of these tests were used to select four coating systems with a high level of spall and/or anticipated corrosion resistance for subsequent 1300°F and 1600°F hot corrosion and erosion-corrosion testing. The four systems selected were: 8 to 10 mil thick 20% Y_2O_3-80% ZrO_2 applied over high Cr (35%) NiCoCrAlY, 1 to 3 mil thick 20% Y_2O_3-80% ZrO_2 applied over high Cr (35%) NiCoCrAlY, 8 to 10 mil thick 6% Y_2O_3-94% ZrO_2 applied over nominal Cr (18%) NiCoCrAlY, and 1 to 3 mil thick $ZrSiO_4$ applied over nominal Cr (18%) NiCoCrAlY. Except for the $ZrSiO_4$ (zirconium silicate) system, results of 1300°F hot corrosion tests indicated exceptionally good ceramic durability with at least a 13X improvement of hot corrosion life as compared to concurrently tested conventional metallic MCrAlY coatings. At 1600°F the 8 to 10 mil thick ceramics spalled at about one half the corrosion life of conventional metallic coatings. However, even after spalling a thin ceramic layer remained which continued to provide a high level of corrosion protection to 1.5X the corrosion life of concurrently tested metallic coatings, at which point testing was terminated with no evidence of corrosion damage on the ceramic coated specimens.

3302 External Combustion Engines

7829 **(DOE/CS/50225—T1) Review of testing and evaluation of an improved steam engine.** Brobeck, W.M.; Renner, R.A.; Younger, F.C. (Brobeck (William M.) and Associates, Berkeley, CA (USA); Renner (Roy A.), Sonora, CA (USA)). Dec 1981. Contract FG01-80CS50225. 48p. NTIS, PC A03/MF A01. Order Number DE84004340.

An experimental steam engine was tested and evaluated by Dutcher Industries in San Diego, California. The purpose of the project was to improve the thermal efficiency of a small steam power system. A thermal efficiency of 24% was achieved, based on a net system power output of 28 horsepower. While this was a noteworthy improvement over 22% achieved a year earlier, it was short of the goal of 27%. Analysis has shown that 27% is attainable with further engineering development. Design modifications which can lead to improved efficiency are discussed in this report.

7830 **(DOE/CS/50225—T2) System optimization of a high efficiency steam engine. Task 2. Final report.** Schneider, P. (Dutcher Industries, Inc., San Diego, CA (USA)). Nov 1981. Contract FG01-80CS50225. 79p. NTIS, PC A05/MF A01. Order Number DE84004337.

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This project dealt with the thorough testing and documentation of the performance of a steam engine which had been built during a previous program. The engine system was tested and evaluated during 1981. The peak thermal efficiency was 24%, which was less than the project goal of 27%, but higher than any measured previously. It is projected that further refinements and modifications would increase the peak thermal efficiency to 27%, and that development of a three stage engine (the current one is two stage) would result in a peak thermal efficiency of up to 30%.

3303 Electric-powered Systems

7831 **(NP—3770174) Simulation and control element design for a coupled aerodynamic/magnetic system.** Schneider, E. (Hochschule der Bundeswehr Muenchen, Neubiberg (Germany, F.R.)). Nov 1982. 153p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE83770174.

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Aerodynamic effects are among the many problems raised by the Maglev technique and its industrial application, but until recently they were only regarded as disturbances. Theoretical studies as well as model experiments in wind and water tunnels were only interested in optimizing the shape of the vehicle cell. The most important goals of development were low sensitivity to side-wind and a neutral aerodynamic design of the vehicle nose. The present paper investigates the aerodynamic effects by means of extended models. Aerodynamic effects on the elevation control system are considered by a suitable control element structure.

7832 **Design considerations for a lithium-aluminum/iron sulfide electric vehicle battery.** Chilenskas, A.A.; Barry, D.L.; Gay, E.C.; Goto, K.; Kawahara, K.; Shimotake, H. (Argonne National Laboratory, Argonne, IL). *Proceedings, Intersociety Energy Conversion Engineering Conference;* **2**: 579-584(Aug 1982). (CONF-820814—).

From 17. Intersociety Energy Conversion Engineering conference; Los Angeles, CA, USA (8 Aug 1982).

A study on battery-vehicle design interactions was performed jointly by Argonne National Laboratory and Toyota Motor Company. A Toyota Carina converted to electric drive was used to model the performance of an electric vehicle (EV) powered by a lithium-aluminum/iron sulfide battery. Energy and power requirements for the EV were calculated, based upon achieving a range of 120 or 200 km with acceleration requirements typical of today's internal-combustion automobiles. Cell modeling analysis was employed to relate the battery power/energy, P/E (h^{-1}), to its specific energy. Battery weights and volumes were derived for the required conditions.

7833 **A mission analysis of "second" cars to determine electric vehicle suitability.** Nelson, S.H. (Argonne National Laboratory, Argonne, IL). *Proceedings, Intersociety Energy Conversion Engineering Conference;* 1: 278-283(Aug 1982). (CONF-820814—).

From 17. Intersociety Energy Conversion Engineering conference; Los Angeles, CA, USA (8 Aug 1982).

This study analyzes the missions of urban household "second" cars to determine the range specifications for electric vehicles (EVs) to effectively perform these missions. The approach adopted is a detailed analysis of the 1977 National Personal Transportation Survey (NPTS). The data in the NPTS were divided into four categories depending on whether the travel day was a weekday or a weekend and whether or not there were any work trips. Detailed analysis of the four categories indicate that the ranges needed to satisfy at least 25%, 50%, and 75% of urban multicar households are 50, 60, and 75 miles, respectively.

3308 Alternative Fuels

REFER ALSO TO CITATION(S) 7334, 7827

7834 **(CONF-830847—7) Diesel fuel extenders and substitutes.** Griffith, W.L.; Compere, A.L. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 10p. NTIS, PC A02/MF A01. Order Number DE84003402.

From Energy resource management '83; San Francisco, CA, USA (23 Aug 1983).

Several technologies for augmenting fuel oils have been demonstrated. The simplest of these is the direct use of vegetable oils as an extender of diesel fuels. In US tests conducted by the Department of Energy, DOE, in conjunction with International Harvester, IH, a major tractor manufacturer, the use of vegetable oils as a direct diesel fuel replacement or extender in field tractors proved unsatisfactory. The joint DOE-IH tests also covered a number of methods for using ethanol in diesel engines, such as macroemulsions and vaporization/ventilation. For the most part, diesel fuel augmentation with these renewable resource materials was not effective in current equipment. This is important, because equipment, such as tractors, is seldom replaced and is critical to the quality of the owner's life in a developing country. Repair may be hampered by logistics difficulties. Thus, there is a considerable need to develop and provide appropriate fuel oil augmentation methods to developing countries, so that they can use renewable resource technology to meet their most critical needs.

7835 **(PB—83-239459) Optimum engine for methanol utilization. Final report.** (Ricardo Consulting Engineers Ltd., Shoreham-by-Sea (UK)). Apr 1983. 178p. NTIS, PC A09/MF A01.

This report details the work Ricardo Consulting Engineers did in the designing, building and calibrating an engine for methanol utilization incorporating a Ricardo high compression ratio, compact chamber (HRCC) combustion system. Recommendations for further work are also included.

7836 **Performance evaluation of 10% ethanol-gasoline blends in 1980 model year US cars.** Bernstein, L.S.; Brinkman, N.D.; Carlson, R.R. (Exxon Research & Engineering Co.; General Motors Research Laboratory; Systems Control, Inc.). pp 1-15 of Fuel alternatives for the 80's. Warrendale, PA; Society of Automotive Engineers Inc. (1982). (CONF-8210214—).

From Fuel alternatives for the 80's - fuels and lubricants meeting; Toronto, Canada (18 Oct 1982).

The Coordinating Research Council, Inc. (CRC), under contract to the U.S. Department of Energy, conducted controlled tests to determine the effects of 10% ethanol-gasoline blends on emissions, fuel economy, and driveability of 14 - 1980 model year cars representing several emission-control technologies. Two types of ethanol blends were tested, a simple blend with no volatility adjustment, and two volatility-adjusted blends. Addition of 10% ethanol to gasoline resulted in statistically significant changes in emissions, driveability, and efficiency. Statistically significant effect were also found as a result of volatility adjustment. However, because of the limited fleet size, these results should not be used to quantitatively predict effects of the use of ethanol-gasoline blends in the total U.S. vehicle population. (Refs. 11)

36 MATERIALS

REFER ALSO TO CITATION(S) 7117, 7325

7837 **(CONF-8306141—1) Some recent results in wave propagation.** Chen, P.J. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 8p. NTIS, PC A02/MF A01. Order Number DE84003107.

From Conference on waves and stability in continuous media; Cosenza, Italy (11 Jun 1983).

In this largely nontechnical talk I shall describe some of the results concerning wave propagation which we have recently obtained at Sandia National Laboratories. It is my intent to give an overview of three particular areas of endeavor concerning dynamic ferroelectricity, accurate shock amplitude computation and induced discontinuities, and observation of the existence of electrically excitable nonclassical mechanical resonances.

7838 **Structure and growth of thin films.** Vook, R.W. (Syracuse Univ., NY). *International Metallurgical Reviews;* 27: No. 4, 209-245(1982). Contract AC02-77ER04496.

The field of thin films continues to be a dynamic, rapidly changing area of research. It involves the formation of solid materials on an atom-by-atom basis. The complexities of the interaction processes involved in film formation are enormous, but the potential for constructing new and more useful materials is just as great. The purpose in this article is to provide an up-to-date review of the most fundamental aspects of this field. The discussion is limited to films formed by vacuum evaporation and the fundamental processes involved in film growth. A discussion of why particular growth modes occur is followed by a review of the most common methods used in their detection. The basic theory and experimental observations of the three main modes of growth, Volmer-Weber, Frank and Van der Merwe, and Stranski-Krastanov, are then discussed. Epitaxial growth is considered in the context of each particular growth mode. The article concludes with some selected examples of epitaxial polycrystalline growth. 345 references, 35 figures, 3 tables.

3601 Metals And Alloys

REFER ALSO TO CITATION(S) 7084, 7088, 7091, 7105, 7110, 7120, 7330, 7505, 7516, 7561, 8179, 8264, 8283

7839 **(BARC—1154) Effect of temperature on swelling and bubble growth in metals.** Tiwari, G.P. (Bhabha Atomic Research Centre, Bombay (India)). 1982. 10p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704107.

The effect of temperature on the swelling of copper-boron alloys has been studied in the temperature range of 900-1040deg C. It is observed that beyond 1030deg C, swelling as well as the rate of bubble growth decrease. Similar characteristics of the bubble growth have been observed in aluminium-boron alloys also. At 590deg C, the bubble growth in aluminium-boron alloys is faster as compared to that at 640deg C. It thus appears that the swelling as well as the growth of the gas bubble are retarded at temperatures near the melting point in metals. Possible reasons for this kind of behaviour are discussed.

7840 **(BDX—613-3009) Titanium fabrication. Final report.** Ulitchny, M.G. (Bendix Corp., Kansas City, MO (USA)). Dec 1983. Contract AC04-76DP00613. 9p. NTIS, PC A02/MF A01. Order Number DE84004374.

To meet design requirements, large thick wall extrusions were purchased and machined to a final configuration which weighed less than 10 percent of the original extrusion. It quickly became obvious that this was not an effective use of either material or machine shop resources. Therefore, this project, and others, were initiated to evaluate more efficient methods of fabricating large structural components made from various titanium alloys. The

areas studied in depth in this activity included resistance spot welding of Ti-6Al-4V; thermal mechanical forming and bonding and electrical discharge machining; and tool life studies of C-2 grade carbide inserts which were applicable to all machined parts. Results of some of these studies have been applied not only to the parts for which they were originally developed but also to others.

7841 **(CEA-CONF—6515) Preparation of ^{237}Np and ^{239}Pu targets for experiments in a high flux reactor.** Kwinta, J.; Michel, J.J. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 92 - Montrouge (France)). Oct 1982. 11p. (In French). (CONF-821046—5). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704100.

From 11. world conference of the International Nuclear Target Development Society; Seattle, WA, USA (6 Oct 1982).

The fabrication of ^{237}Np and ^{239}Pu deposits by ionic sputtering onto nickel foil is described. Such targets are to be irradiated in the ILL high flux reactor at Grenoble. The most important specifications are therefore the quality of the adherence of the deposit and its good behavior at high temperatures (500 to 1000°C). ^{239}Np deposits are made by sputtering NpO_2 It is observed that deposits made by sputtering plutonium metal in a 10^{-6} ton vacuum oxidize rapidly (the corresponding structures being revealed by photoelectron spectroscopy). The final result is a PuO_2 deposit satisfying the requirements specified.

7842 **(CEA-CONF—6622) Collection of creep fatigue laws and their comparison with experimental data.** Rieunier, J.B.; Dufresne, J. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France)). Jul 1982. 24p. (DSN—563; CONF-820601—34). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704108.

From ASME pressure vessel and piping conference; Orlando, FL, USA (27 Jun 1982).

A systematic investigation has been undertaken to collect the main model describing phenomena of creep-fatigue interaction. A total of 13 models was collected. Simultaneously, 660 experimental data on 304 stainless steel were collected and compared to the results obtained from theoretical models. Conclusion are that none of these models describes correctly all phenomena considered (imposed strain or stress - hold time - two strain levels etc...) but each of those phenomena is well represented by some laws.

7843 (CEA-N—2349, pp 3) **New constitutive equations to describe infinitesimal elastic-plastic deformations. Part. 4; Contributions - Session 2.** Boecke, B.; Link, F.; Schneider, G.; Bruhns, O.T. May 1983. NTIS (US Sales Only), MF A01. (CONF-8210221—).

From IAEA specialist meeting on advances in structural analysis for LMFBR applications; Paris, France (11 Oct 1982).

A set of constitutive equations is presented to describe infinitesimal elastic-plastic deformations of austenitic steel in the range up to 600°C. This model can describe the hardening behaviour in the case of mechanical loading and hardening and softening behaviour in the case of thermal loading. The loading path can be either monotonic or cyclic. For this purpose, the wellknown isotropic hardening model is continually transferred into the kinematic model according to Prager, whereby suitable internal variables are chosen. The occuring process-dependent material functions are to be determined by uniaxial experiments. The hardening function and the translation function are determined by means of a linearized stress-strain behaviour in the plastic range, whereby a coupling condition must be taken into account. As a linear hardening process is considered to be too unrealistic, nonlinearity is achieved by introducing a small function w, the determination procedure of which is given.

7844 (CEA-N—2349, pp 3) **Inelastic analysis of moving temperature fronts. Part. 4; Contributions - Session 2.** Jobson, D.A. May 1983. NTIS (US Sales Only), MF A01. (CONF-8210221—).

From IAEA specialist meeting on advances in structural analysis for LMFBR applications; Paris, France (11 Oct 1982).

7845 **(CONF-820727—6) Magnetic domains in rare-earth cobalt permanent magnets.** Hadjipanayis, G.C.; Hazelton, R.C.; Lawless, K.R.; Horton, L.S. (Kollmorgen Corp., Radford, VA (USA); Virginia Univ., Charlottesville (USA); Oak Ridge National Lab., TN (USA)). 1982. Contract W-7405-ENG-26. 12p. NTIS, PC A02/MF A01. Order Number DE83015529.

From 3. joint intermag-magnetism and magnetic materials conference; Montreal, Canada (17 Jul 1982).

The microstructure of two commercial 2:17 precipitation hardened rare-earth magnets has been examined and compared with the magnetic properties. Transmission electron microscope studies on $Sm(Co,Fe,Cu,Hf)_{7.25}$, Hicorex 99C show a fine cellular microstructure with 2:17 rhombohedral cells surrounded by coherent 1:5 hexagonal cell boundaries. In $Sm(Co,Fe,Cu,Zr)_{7.22}$, TDK REC-26 the cells are much coarser and 1:3 phase thin lamellae are superimposed on the cellular structure. X-ray energy dispersive analysis shows a higher Cu content in the cell boundaries. Lorentz electron microscopy shows wavy domain walls in both cases indicating that the domain walls are pinned at the cell boundaries. The higher Cu content of the cell boundaries dilutes the magnetic properties of the $SmCo_5$, phase and produces a large domain wall energy gradient across the cell boundary leading to the observed high coercivities.

7846 **(CONF-830942—69) Dislocation sweeping of defects in neutron- and electron-irradiated niobium.** Loomis, B.A.; Otero, M.P. (Argonne National Lab., IL (USA); Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). Oct 1983. Contract W-31-109-ENG-38. 3p. NTIS, PC A02/MF A01. Order Number DE84003639.

From 3. topical meeting on fusion reactor materials; Albuquerque, NM, USA (19 Sep 1983).

The glide of dislocations in a [441]-oriented Nb single crystal irradiated at 325 K with 5.5×10^{21} neutrons/m^2 ($E > 0.1$ MeV) is shown for increasing time of tensile elongation (2×10^{-4} mm/s) in the High Voltage Electron Microscope at Argonne National Laboratory. The dimensions of the tensile specimen in the guage length were approximately 2 mm x 0.5 mm x 0.0001 mm. An electron energy of 900 keV was used during the simultaneous deformation and TEM observation.

7847 **(CONF-830942—72) Compatibility of materials for use in liquid-metal blankets of fusion reactors.** Chopra, O.K.; Tortorelli, P.F. (Argonne National Lab., IL (USA); Oak Ridge National Lab., TN (USA)). Nov 1983. Contract W-31-109-ENG-38. 13p. NTIS, PC A02/MF A01. Order Number DE84003997.

From 3. topical meeting on fusion reactor materials; Albuquerque, NM, USA (19 Sep 1983).

A review of corrosion and environmental effects on the mechanical properties of austenitic and ferritic steels for use with liquid metals in fusion reactors is presented. The mechanisms and kinetics of the corrosion processes in liquid lithium and Pb-17Li systems are examined and their influence on degradation of structural material is discussed. Requirements for additional data are identified.

7848 **(CONF-830942—77) Temperature dependence of the damage microstructures in neutron-irradiated vanadium.** Horton, L.L.; Farrell, K. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 6p. NTIS, PC A02/MF A01. Order Number DE84003412.

From 3. topical meeting on fusion reactor materials; Albuquerque, NM, USA (19 Sep 1983).

Vanadium and vanadium with boron carbide additions (V-B_4C) were irradiated to $\sim$ 1 dpa in the Oak Ridge Research Reactor at controlled temperatures ranging from 455 to 925 K. The V-B_4C alloy was enriched in ^{10}B, which produced $\sim$ 3900 at. ppM helium. In the vanadium specimens, the dislocation microstructures varied from clusters of small (< 50 nm diam) dislocation loops (455 to 625 K) to larger, homogeneously distributed loops at higher temperatures. Their Burgers vectors were $a/2\langle 111\rangle$. The V-B_4C specimens contained only tangled dislocation segments. Cavities were observed in all specimens. The cavity concentration decrease and the average diameter increased with increasing irradiation temperature. At 725 K, the maximum swelling was observed in both

the vanadium (0.1%) and V-B_4C (1.4%). At comparable temperatures the cavities in the V-B_4C specimens were smaller and more numerous than those in the vanadium specimens. Helium bubbles were found on the grain boundaries in all of the V-B_4 specimens.

7849 **(CONF-831012—10) Comparison of fission neutron and pulsed spallation neutron sources for radiation effects experiments on Cu_3Au.** Kirk, M.A. (Argonne National Lab., IL (USA)). Oct 1983. Contract W-31-109-ENG-38. 9p. NTIS, PC A02/MF A01. Order Number DE84003648.

From International symposium on use and development of low and medium flux research reactors; Cambridge, MA, USA (17 Oct 1983).

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Through our recent experimental work on the neutron irradiation effects in Cu_3Au, we will compare fission and pulsed spallation neutron sources. Neutron characteristics of irradiation facilities at the Intense Pulsed Neutron Source (IPNS) and the CP-5 reactor (now closed down), are briefly described. Defect cascade size distributions from irradiations of Cu_3Au at both neutron sources illustrated by transmission electron micrographs of disordered zones. Radiation-enhanced diffusion experiments in Cu_3Au are discussed along with the effect of pulsed neutron irradiations.

7850 **(CONF-831174—49) Modification of μm thick surface layers using keV ion energies.** Rehn, L.E.; Lam, N.Q.; Wiedersich, H. (Argonne National Lab., IL (USA)). Nov 1983. Contract W-31-109-ENG-38. 7p. NTIS, PC A02/MF A01. Order Number DE84004041.

From Materials Research Society annual meeting; Boston, MA, USA (14 Nov 1983).

Root-mean-square diffusion distances for both vacancy and interstitial defects in metals can be very large at elevated temperatures, e.g. several μm's in one second at 500°C. Consequently, defects that escape the implanted region at elevated temperature can produce conpositional and microstructural changes to depths which are much larger than the ion range. Because of the high defect mobilities, and of the fact that diffusion processes must compete with the rate of surface recession, the effects of defect production (ballistic mixing), radiation-enhanced diffusion and radiation-induced segregation become spatially separated during ion bombardment at elevated temperature. Results of such experimental studies in a Cu-Ni alloy are presented, discussed and compared with predictions of a phenomenological model. Contributions to the subsurface compositional changes from radiation-enhanced diffusion and radiation-induced segregation are clearly identified.

7851 **(CONF-8310143—60) Evaluation of stainless steel pipe cracking: causes and fixes.** Shack, W.J..; Kassner, T.F.; Maiya, P.S.; Nichols, F.A.; Park, J.Y.; Ruther, W.; Rybicki, E.F. (Argonne National Lab., IL (USA)). Oct 1983. Contract W-31-109-ENG-38. 24p. NTIS, PC A02/MF A01. Order Number DE84003459.

From 11. NRC water reactor safety research information meeting; Gaithersburg, MD, USA (14 Oct 1983).

Leaks and cracks in the heat-affected zones of weldments in austenitic stainless steel piping and associated components of boiling water reactors (BWRs) have been observed since the mid-1960s. Since that time, cracking has continued to occur and indications have been found in all parts of the recirculation system, including the largest diameter lines. Proposed solutions include remedies primarily intended to produce a more favorable residual stress state, materials which are more resistant to stress corrosion cracking (SCC), and changes in the reactor environment which decrease the susceptibility to cracking. In addition to evaluating these remedies, it is also important to gain a better understanding of key variables such as residual stresses, crack growth rates, and the leak-before-break margin in flawed piping, which may impact regulatory decisions on operating plants. The main areas of effort during the past year have been (1) studies of impurity effects on susceptibility to intergranular stress corrosion cracking (IGSCC), (2) crack growth rate measurements, (3) finite-element studies of residual stress produced by induction heating stress improvement (IHSI) and the addition of weld overlays to flawed piping, (4) leak-before-break analyses of piping with 360° part-through cracks, and (5) parametric studies on the effect of through-wall residual stresses on IGSCC crack growth behavior in large-diameter piping weldments. 5 references, 15 figures, 2 tables.

7852 **(CONF-8310143—65) Aging degradation of cast stainless steel: status and program.** Chopra, O.K.; Ayrault, G. (Argonne National Lab., IL (USA)). Oct 1983. Contract W-31-109-ENG-38. 19p. NTIS, PC A02/MF A01. Order Number DE84004018.

From 11. NRC water reactor safety research information meeting; Gaithersburg, MD, USA (14 Oct 1983).

A program has been initiated to investigate the significance of in-service embrittlement of cast duplex stainless steels under light-water reactor operating conditions. The existing data are reviewed to determine the critical parameters that control the aging behavior and to define the objectives and scope of the investigation. The test matrices for microstructural studies and mechanical property measurements are presented. The initial experimental effort is focussed on characterizing the microstructure of long-term, low-temperature aged material. Specimens from three heats of cast CF-8 and CF-8M stainless steel aged for up to 70,000 h at 300, 350, and 400°C were obtained from George Fisher Ltd., of Switzerland. Initial analyses reveal the formation of three different types of precipitates which are not α'. An FCC phase, similar to the $M_{23}C_6$ precipitates, was present in all the long-term aged material. 15 references, 10 figures, 2 tables.

7853 **(CONF-8310205—3) Effects of nominal and crack-tip strain rate on IGSCC susceptibility in CERT tests.** Maiya, P.S.; Shack, W.J. (Argonne National Lab., IL (USA)). Sep 1983. Contract W-31-109-ENG-38. 12p. NTIS, PC A02/MF A01. Order Number DE84004006.

From TMS-AIME fall meeting; Philadelphia, PA, USA (2 Oct 1983).

Constant extension rate tests have been performed on sensitized Type 316 stainless steel in oxygenated water (8 ppM O_2) containing chloride ion impurities (0.5 ppM) over a range of strain rates from 10^{-5} to 2 x 10^{-7} s^{-1}. The susceptibility to IGSCC (as quantified by parameters such as crack length at failure) increases with a decrease in strain rate. A model consistent with the observed and postulated crack growth behavior and with a fracture criterion is presented and used to derive power laws that relate the IGSCC susceptibility parameters and strain rate. The predicted strain rate exponents are in agreement with the experimental results of this and other studies. The correlations between IGSCC susceptibility and strain rate can be used to predict susceptibility to cracking outside the range of conditions used in the laboratory. In addition, it is shown that the average crack-tip strain rate in CERT experiments can be estimated by use of a J-integral approach. It is observed that the average crack growth rate is proportional to the square root of the estimated average crack-tip strain rate. The experimentally observed correlation is in good agreement with that deduced from a slip-dissolution model proposed by Ford.

7854 (DOE/ER—0046/14, pp 9-18) **Fission reactor dosimetry - HFIR - CTR 31, 32, 34, and 35.** Greenwood, L.R. (Argonne National Lab., IL). Aug 1983. NTIS, PC A08/MF A01.

In Damage analysis and fundamental studies. Quarterly progress report, April-June 1983.

Damage and gas production data are summarized for the CTR 31, 32, 34 and 35 irradiations in HFIR. The helium production from nickel has been revised according to new cross-section evaluations for ^{58}Ni. The status of all other experiments is summarized.

7855 (DOE/ER—0046/14, pp 33-50) **Computer simulation of displacement cascades in copper.** Heinisch, H.L. (Westinghouse Hanford Co., Richland, WA). Aug 1983. NTIS, PC A08/MF A01.

In Damage analysis and fundamental studies. Quarterly progress report, April-June 1983.

A compendium of information on computer - simulated displacement cascades in copper is now available, and it is summarized here. The compendium contains graphical depictions of 21 cascades ranging in energy from 1 to 200 keV, along with quantitative analyses of cascade shapes and sizes and defect densities within cascades. The pictures clearly show that with increasing PKA energy, cascade configurations undergo a transition from production of a single compact damage region to widely spaced multiple damage

regions. The number of distinct damage regions ("lobes") per cascade is found to increase uniformly with PKA damage energy beginning at about 30 to 50 keV. The high-energy cascades, although highly irregular in shape, have been classified into two main categories of shapes: starbursts and chains. The defect density of the cascades decreases with increasing energy, but the average localized defect density remains constant.

7856 (DOE/ER—0046/14, pp 51-60) **14-MeV neutron radiation-induced microhardness increase in copper alloys.** Zinkle, S.J.; Kulcinski, G.L. (Univ. of Wisconsin, Madison). Aug 1983. NTIS, PC A08/MF A01.

In Damage analysis and fundamental studies. Quarterly progress report, April-June 1983.

Vickers microhardness measurements have been performed on copper and copper alloy (Cu-5% Al, Cu-5% Mn, Cu-5% Ni) TEM disks which were irradiated at room temperature with 14-MeV neutrons in incremental doses up to a maximum fluence of 2.2 x 10^{21} n/m^2. After an initial incubation period, the radiation-induced hardness was found to be proportional to the square root of neutron fluence for all four metals. This result is in good agreement with previously reported pure copper resistivity data. The incubation period range from $\leqq$ 1 x 10^{20} n/m^2 for the alloys to about 4 x 10^{20} n/m^2 for pure copper. The copper alloys also exhibited a larger radiation-induced hardness increase than the pure copper samples. The Cu-5% Mn samples showed a significantly larger radiation hardening than any of the other samples. Anomalous behavior of the irradiated Cu-5% Mn samples compared to the other alloys was also observed in reported resistivity data.

7857 (DOE/ER—0046/14, pp 69-84) **Effect of neutron and helium irradiation on fracture modes.** Hanamura, T.; Jesser, W.A. (Univ. of Virginia, Charlottesville). Aug 1983. NTIS, PC A08/MF A01.

In Damage analysis and fundamental studies. Quarterly progress report, April-June 1983.

Neutron and helium irradiation were found to hinder Mode II failure and increase Mode I cracking instead. Over the temperature range studied (25 to 600°C) irradiated specimens showed that Mode II intergranular failure was absent and intergranular failure occurred mostly by a Mode I crack opening. In unirradiated specimens tested under the same tensile conditions as for the irradiated specimens, Mode II crack opening at the grain boundaries was present.

7858 (DOE/ER—0046/14, pp 85-95) **Characterization of localized plastic flow by indentation geometry analysis.** Jayakumar, M.; Lucas, G.E. (Univ. of California, Santa Barbara). Aug 1983. NTIS, PC A08/MF A01.

In Damage analysis and fundamental studies. Quarterly progress report, April-June 1983.

Seven alloys, heat treatable to a range of strengths and ductilities, have been investigated. Specimens were fabricated and pulled in uniaxial tension as well as subjected to indentation hardness. Both tensile and hardness specimen surfaces were replicated and examined by transmission electron microscopy. In addition, hardness indentations were examined by multiple beam and differential interference techniques. It was observed that specimens exhibiting very coarse slip produced quite asymmetric pile-ups around the indentations, whereas specimens exhibiting fine slip produced indentations which were symmetric in their pile-up.

7859 (DOE/ER—0046/14, pp 96-108) **Fundamental flow and fracture analysis of prime candidate alloy (PCA) for path a (austenitics).** Lucas, G.E. (Univ. of California, Santa Barbara); Brashear, P.; Maziasz, P.J. Aug 1983. NTIS, PC A08/MF A01.

In Damage analysis and fundamental studies. Quarterly progress report, April-June 1983.

Work has proceeded in two different areas. In the first, shear punch tests were performed on several microstructures of PCA and values of room temperature yield stess, ultimate tensile strength, and reduction in area were predicted. This was done as a blind test, with actual experimental values of the corresponding parameters determined separately at ORNL. Quite good agreement was obtained between predicted and actual values of the strength parameters. In the second area, techniques have been developed to test miniaturized tensile specimens under creep and creep rupture conditions; a creep test program has been initiated on the A3 and B2 microstructures of PCA, and preliminary results, compared to MFE 316 stainless steel, are reported here.

7860 (DOE/ER—0046/14, pp 111-119) **Suppression of void nucleation by injected interstitials for medium energy ions.** Plumton, D.L.; Attaya, H.M.; Wolfer, W.G. (Univ. of Wisconsin, Madison). Aug 1983. NTIS, PC A08/MF A01.

In Damage analysis and fundamental studies. Quarterly progress report, April-June 1983.

The effect of injected interstitials on void nucleation depends on the precise distribution of both the displacement damage and the deposited ions. The lower the ion energy, the larger the overlap of these two distributions. These distributions have been obtained for 5 MeV Ni ion bombardment of nickel using two different computer codes. The BRICE and HERAD codes were used to evaluate the depth distribution of the void nucleation rate. Significant differences were found for the degree and range of void nucleation suppression.

7861 (DOE/ER—0046/14, pp 120-132) **Microsegregation induced in Fe-35.5Ni-7.5Cr by irradiation in EBR-II.** Brager, H.R.; Garner, F.A. (Hanford Engineering Development Lab., Richland, WA). Aug 1983. NTIS, PC A08/MF A01.

In Damage analysis and fundamental studies. Quarterly progress report, April-June 1983.

The examination was continued of composition oscillations in an annealed Fe-35.5Ni-7.5Cr alloy which is resistant to void formation. Energy dispersive x-ray measurements were made of the matrix composition along straight lines at smaller intervals (50 vs 200 nm) than previously reported. These data better delineate the oscillations in composition measured in this single phase material irradiated in the EBR-II at 593°C to ~ 40 dpa and verify previous EDX results. The matrix composition of unirradiated specimens were also examined by EDX and showed only minimal spatial variations.

7862 (DOE/ER—0046/14, pp 133-151) **Dependence of swelling on nickel and chromium content in Fe-Ni-Cr ternary alloys.** Garner, F.A. (Hanford Engineering Development Lab., Richland, WA). Aug 1983. NTIS, PC A08/MF A01.

In Damage analysis and fundamental studies. Quarterly progress report, April-June 1983.

The steady-state swelling rate of EBR-II irradiated ternary alloys with $\leqq$ 35% nickel appears to be approximately 5% per 10^{22} n cm^{-2} (E > 0.1 MeV) or 1%/dpa, independent of chromium and/or nickel content and also independent of the irradiation temperature in the range 400 to 600°C. The duration of the transient regime of swelling is sensitive to these three variables, however, tending to increase with increasing nickel or temperature or decreasing chromium content. A similar relative independence of the steady-state swelling rate on temperature has been also observed in commercial stainless steels, which also appear to be approaching a swelling rate of 1%/dpa at high fluence. There is some evidence that elemental segregation plays a role in the compositional dependence of swelling.

7863 (DOE/ER—0046/14, pp 152-159) **Swelling of high nickel Fe-Ni-Cr alloys in EBR-II.** Brager, H.R.; Garner, F.A. (Hanford Engineering Development Lab., Richland, WA). Aug 1983. NTIS, PC A08/MF A01.

In Damage analysis and fundamental studies. Quarterly progress report, April-June 1983.

Swelling data on Fe-Ni-Cr alloys with nickel in the 35 to 75 wt% range as been obtained to fluences as large as 2.2 x 10^{23} n/cm^2 (E > 0.1 MeV) (~ 110 dpa). At 15% chromium the swelling rate at 35, 45 and 75% nickel continues to increase with accumulating exposure, most clearly approaching 1%/dpa at ~ 35% nickel. The minimum often observed in swelling at ~ 45% nickel appears to be due to a maximum in the duration of the transient regime at this composition. Decreasing the chromium level from 15 to 7.5% extends the transient regime even further.

7864 **(DOE/ER/10428—5) Protective oxide films. Progress report, April 1-November 30, 1983.** MacCrone, R.K. (Rensselaer Polytechnic Inst., Troy, NY (USA). Dept. of Materials Engineering). 1983. Contract AC02-79ER10428. 25p. NTIS, PC A02/MF A01. Order Number DE84004088.

Portions are illegible in microfiche products.

The first subject was concerned with the formation of metallic inclusions in NiO scales. This indicates extreme deviations in a system long thought to be ideal. We have examined the dependence of this deviation on the oxidizing conditions such as temperature, partial pressure of oxygen, surface preparation, and grain size. Results show that the departure from ideality is most likely due to nonidealities at the oxide-metal interface such as cracks, nonplanar regions, and grain boundaries in the oxide and metal substrate. The second subject was concerned with the oxidation of TiO_2. In this case, the defects responsible for the oxidation are detected by EPR. Measurements have been made at low temperatures on specimens oxidized at different temperatures and oxygen partial pressures. Metal of two different purities were used, the impurity content being determined by XRFS. Results show that the purity of the base metal plays an important role; impurities may suppress the dependence of the Ti interstitial concentration on oxygen partial pressure.

7865 **(DOE/ER/10942—4) Experimental studies on age-hardening in spinodally-modulated Cu-10Ni-6Sn alloy.** Subramanian, K.N. (Michigan State Univ., East Lansing (USA). Dept. of Metallurgy, Mechanics and Material Science). [nd]. Contract AC02-81ER10942. 21p. NTIS, PC A02/MF A01. Order Number DE84004427.

Preliminary results of in-situ HVEM straining studies of Cu-10Ni-6Sn spinodal alloy have been very promising. Tensile specimen preparation procedures have been completely successful. Grain boundary cracking during in-situ straining has not been of any concern during these studies, since large-grained samples (with grains as large as 2 to 3 mm) were used. Single crystal specimens will be used in some of the future studies. Future studies will be devoted to understanding of micro-mechanical deformation characteristics of spinodally-modulated Cu-10Ni-6Sn alloy, so as to understand the age-hardening mechanism in such structures.

7866 **(DOE/ER/10942—5) Effect of temperature on some of the mechanical properties of Cu-10Ni-6Sn spinodal alloy.** Vilassakdanont, A.; Subramanian, K.N. (Michigan State Univ., East Lansing (USA). Dept. of Metallurgy, Mechanics and Material Science). 1983. Contract AC02-81ER10942. 22p. (CONF-8310205—6). NTIS, PC A02/MF A01. Order Number DE84004432.

From TMS-AIME fall meeting; Philadelphia, PA, USA (2 Oct 1983).

Tensile tests on Cu-10Ni-6Sn spinodal alloy were carried out with polycrystalline samples in as-quenched and aged conditions at various temperatures ranging from 77°K to 353°K. There was no marked difference in activation energy for plastic flow of as-quenched and aged specimens. The work-hardening rate and the total elongation were found to be independent of the amplitude and wavelength of the composition modulation in the spinodally-modulated structure. Deformation of the aged specimens was accommodated by coarse slip, whereas the as-quenched specimens deformed by fine slip.

7867 **(DOE/ER/10942—6) Theoretical model for age-hardening in later stages of spinodal decomposition.** Lee, T.C.; Subramanian, K.N. (Michigan State Univ., East Lansing (USA). Dept. of Metallurgy, Mechanics and Material Science). 1983. Contract AC02-81ER10942. 15p. (CONF-8310205—5). NTIS, PC A02/MF A01. Order Number DE84004430.

From TMS-AIME fall meeting; Philadelphia, PA, USA (2 Oct 1983).

A two-dimensional composition modulation model was used to represent the later stages of spinodal decomposition of an fcc spinodal alloy. The critical resolved shear stress (CRSS) and activation energy were calculated numerically using the dislocation force-balance equation with this model. Results show that, during later stages of decomposition, CRSS and activation energy have the same results as in the earlier stages of decomposition. A consideration of three-dimensional modulation is also presented, and the results indicate that the effects are the same as in the two-dimensional case.

7868 **(DOE/ER/10942—7) Mechanical behavior of Cu-10Ni-6Sn spinodal alloy.** Lee, T.C.; Shekhar, S.; Vilassakdanont, A.; Subramanian, K.N. (Michigan State Univ., East Lansing (USA). Dept. of Metallurgy, Mechanics and Material Science). 1982. Contract AC02-81ER10942. 7p. NTIS, PC A02/MF A01. Order Number DE84004642.

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Experimental studies on deformation behavior of Cu-10Ni-6Sn spinodal alloy specimens subjected to different aging treatments were carried out at various temperatures ranging from 77°K to 353°K, using a micro-tensile device. It was found that the total elongation was independent of aging time as long as the modulated structure was coherent. Observed slip distribution and activation energy obtained in these investigations are presented. Transmission electron microscopy of deformed specimens showed straight dislocations in as-quenched samples; they were curved and wavy in aged samples. Burgers vector analysis of the dislocations present in the deformed aged samples indicated that they were of mixed character. Preliminary theoretical results on the role of wave-squaring of the internal stress field on CRSS are also presented.

7869 **(DOE/ER/12038—8) Workhardening correlations based on state variables in some FCC metals in monotonic loadings.** Korhonen, M.A.; Hannula, S.P.; Li, C.Y. (Cornell Univ., Ithaca, NY (USA). Dept. of Materials Science and Engineering). Oct 1983. Contract AC02-82ER12038. 47p. NTIS, PC A03/MF A01. Order Number DE84004880.

This paper reports an investigation based on a state variable approach of workhardening properties of 316 stainless steel, commercial purity aluminium and OFHC copper at room temperature. It is proposed that a generalized workhardening correlation can be formulated by using two state variables only, the structural state parameter and the inelastic strain rate. Particularly, an absolute workhardening coefficient is proposed to be a product of two parts: the athermal part, which is structure dependent only, will be approached at low homologous temperatures and/or high strain rates, while the strain rate sensitive part describes a dynamic recovery contribution at high homologous temperatures and/or low strain rates. Moreover, it is shown that a single master curve can be constructed to display the dependence of workhardening coefficient on structure and strain rate.

7870 **(DOE/ER/12038—9) Repeated load relaxations of Type 316 austenitic stainless steel.** Hannula, S.P.; Li, C.Y. (Cornell Univ., Ithaca, NY (USA). Dept. of Materials Science and Engineering). Oct 1983. Contract AC02-82ER12038. 7p. NTIS, PC A02/MF A01. Order Number DE84004875.

Results demonstrate that strain aging has a clear effect on the relaxation behavior of 316 SS even at room temperature, the effect being more pronounced at high strains. It is suggested that the phenomena can be accounted for according to a state variable model by modifying the rate constant a*, which is affected by the amount of mobile dislocations as well as the dislocation mobility.

7871 **(DOE/ER/12038—10) Applicability of Hart's state variable model to large strain rate ranges.** Henderson, D.W.; Kuo, R.C.; Li, C.Y. (Cornell Univ., Ithaca, NY (USA). Dept. of Materials Science and Engineering). Oct 1983. Contract AC02-82ER12038. 10p. NTIS, PC A02/MF A01. Order Number DE84004878.

A comparison is reported of the plastic flow properties of two metals with a state variable model for plastic deformation originally proposed by Hart. Only a qualitative comparison is possible. However within this limitation, agreement is good over a strain rate range of thirteen orders of magnitude.

7872 **(DOE/ER/12038—11) Load relaxation testing at medium strain rates.** Henderson, D.W.; Kuo, R.C.; Li, C.Y. (Cornell Univ., Ithaca, NY (USA). Dept. of Materials Science and Engineering). Oct 1983. Contract AC02-82ER12038. 26p. NTIS, PC A03/MF A01. Order Number DE84004877.

The feasibility of a new mechanical testing technique is described. This technique allows the collection of load relaxation type data at higher strain rates than is possible in a conventional load relaxation test. This technique was used in commercial purity aluminum and 304 stainless steel at strain rates up to 5/s. Good agreement with Hart's state variable model for plastic deformation was found.

7873 **(DOE/ER/12038—12) Finite element analysis of metal forming processes with thermomechanical coupling.** Chandra, A.; Mukherjee, S. (Cornell Univ., Ithaca, NY (USA). Dept. of Theoretical and Applied Mechanics). Oct 1983. Contract AC02-82ER12038. 41p. NTIS, PC A03/MF A01. Order Number DE84004879.

A finite element analysis is presented for warm forming problems. Thermomechanical coupling is included and an elastic-viscoplastic material model is used. This formulation is capable of using any of a class of combined creep-plasticity constitutive models with state variables for the description of material behavior. The specific problem considered is plane strain extrusion using the constitutive model originally proposed by Hart. Numerical results are presented for sample problems and the important effects of extrusion speed and friction (at the die-workpiece interface) on the residual stresses and temperature fields are investigated. The computer program developed is quite general and can be modified to analyze other manufacturing processes like rolling, sheet metal forming, etc. as well. It can also be modified to use other similar constitutive models for the description of material behavior.

7874 **(DOE/ER/12038—13) Summary of recent investigations of the mechanical properties of polycrystalline solids.** Li, C.Y.; Mukherjee, S. (Cornell Univ., Ithaca, NY (USA)). Oct 1983. Contract AC02-82ER12038. 135p. NTIS, PC A07/MF A01. Order Number DE84004876.

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A summary of recent investigations of the mechanical properties of polycrystalline materials is given. The areas of study have included: (1) mechanical testing at medium and strain rates; (2) mechanical properties of metals and alloys at elevated strain rates; (3) the development of a state variable description of work-hardening processes; (4) the time dependence of state variable parameters due to thermally induced effects; (5) grain boundary sliding behavior and its correlation with time to rupture data; and (6) finite element modeling of metal forming processes. In general a state variable approach has been taken in developing a description of the deformation and related phenomena.

7875 **(FEI—1175) Kh13M2S2 steel fatigue under nonstationary temperature-stress conditions.** Pykhtin, V.M. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1982. 21p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704110.

Durability of tube and flat samples of Kh13M2C2 steel during step changing stresses and temperatures is investigated. It is shown that under conditions of two- and three- stepped regimes the accumulation of damages takes place in a non-linear way: with the increase of the regime parameters the weakening of steel occurs, with the decrease - a certain strengthening. Calculations are made according to 8 known methods of fracture summing and according to the one suggested by the author. It is shown the methods presenting the sum of damage, close to 1, during calculation of durability result in elevated values of durability, considerable variation and distribution of deviations, different from the normal one. The optimum methods for calculation the durability of the steel investigated under nonstationary regimes are recommended.

7876 **(FEI—1303) Effect of composition on carbon diffusion in low (pearlitic) steels of 10Kh2M type.** Pavlinov, L.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1982. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704111.

Carbon diffusion in low-alloy (pearlitic) steels of 10Kh2M type with slightly different content of alloying elements and impurities was studied. The diffusion coefficients were determined using the technique of carburization in sodium by means of the radioactive C^{14} carbon source at 450-700 deg C. The diffusional carbon mobility in the studied steels was shown to depend on comparatively small differences in molybdenum content.

7877 **(FRNC-TH—1160(Pt.1)) Interaction fatigue-creep-environment in an austenitic stainless steel Z2 CND 17-13 (Type 316 L) at 600 and 650 deg C. Microstructural evolution and damage.** Rezgui, B. (Paris-11 Univ., 91 - Orsay (France)). Dec 1982. 138p. (In French). NTIS (US Sales Only), PC A07/MF A01. Order Number DE84700209.

The resistance of steel to continuous fatigue is directly related to its behaviour towards the surroundings (oxidation). This interaction considerably lowers resistance to crack initiation but has no effect on propagation, and rupture is transgranular. Conversely the influence of the environment is negligible under fatigue conditions with a hold time and rupture becomes intergranular whatever the surroudings. Cavities are created inside the material during the hold time and their interaction with each other and with cracks from the surface are the factors responsible for the degradation of fatigue properties. Transgranular rupture initiated in slip bands, which characterises damage by pure fatigue, is gradually replaced by intergranular rupture under fatigue with hold time. Meanwhile a new deformation mode appears: intergranular slip. The longer the hold time the stronger its effect, a tendency offset at high temperature. Hold time, temperature and deformation promote dynamic structural aging and restoration in the material. Since the mechanisms and kinetics of creep fatigue damage are different according to the deformation level and the hold time duration it would not be safe to extrapolate the results.

7878 **(FRNC-TH—1160(Pt.2)) Interaction fatigue-creep-environment in an austenitic stainless steel Z2 CND 17-13 (Type 316 L) at 600 and 650 deg C. Microstrutural evolution and damage: iconography.** Rezgui, B. (Paris-11 Univ., 91 - Orsay (France)). Dec 1982. 156p. (In French). NTIS (US Sales Only), PC A08/MF A01. Order Number DE84700210.

This paper contains only tables, graphs and photomicrographs related to thermal fatigue of a 316 L type stainless steel at 600 and 650 deg C. Low cycle fatigue and influence of creep, stress, time, oxidation, relaxation, hardening, cracks and direction of samples (parallel and perpendicular to rolling) are studied.

7879 **(HEDL—7418) J/sub 1c/ fracture toughness transition behavior of HT-9.** Huang, F.H. (Westinghouse Hanford Co., Richland, WA (USA)). Nov 1983. Contract AC06-76FF02170. 9p. NTIS, PC A02/MF A01. Order Number DE84004593.

Small compact tension specimens of two heats of HT-9 were tested at temperatures ranging from room temperature to -192°C. The ductile-brittle transition toughness of HT-9 was evaluated using the J-integral approach. There were two loading rates of 2.1 x 10^{-5} m/s and 3.2 x 10^{-2} m/s. The ductile-brittle transition temperatures of HT-9 (No. 1 heat) tested at 2.1 x 10^{-5} m/s and HT-9 (No. 2 heat) tested at 3.2 x 10^{-2} m/s were found to be -60 and -10°C, respectively. Results showed the fracture toughness of the former was not sensitive to loading rate and the lower shelf toughness decreased with temperature to a J/sub 1c/ value of 5 kJ/m^2 at -190°C. Furthermore, the values of J/sub 1c/ were valid since the thickness of the test specimens was well above the thickness criterion.

7880 **(HEDL—7419) Fracture toughness of ferritic alloys irradiated in HFIR.** Huang, F.H. (Westinghouse Hanford Co., Richland, WA (USA)). Nov 1983. Contract AC06-76FF02170. 6p. NTIS, PC A02/MF A01. Order Number DE84004594.

The fracture toughness of HT-9 and 9Cr-1Mo irradiated in HFIR to 10 dpa at 50°C was evaluated using electropotential single specimen techniques. Circular compact tension specimens were tested at temperatures ranging from room temperature to 450°C. The test results were analyzed using the J-integral approach. Analyses showed that the fracture toughness of both alloys was reduced as a result of HFIR irradiation. The degradation of irradiation toughness resistance was more severe for 9Cr-1Mo than HT-9. The thickness criterion for valid J/sub 1c/ values was satisfied by the thickness of the test specimens.

7881 **(HEDL-SA—2904-FP) Thermal creep and stress-affected precipitation of 20% cold-worked 316 stainless steel.** Puigh, R.J.; Lovell, A.J.; Garner, F.A. (Hanford Engineering Development Lab., Richland, WA (USA)). Aug 1983. Contract AC06-76FF02170. 5p. (CONF-830942—76). NTIS, PC A02/MF A01. Order Number DE84004933.

From 3. topical meeting on fusion reactor materials; Albuquerque, NM, USA (19 Sep 1983).

Measurements of the thermal creep of 20% cold-worked 316 stainless steel have been performed for temperatures from 593 to 760°C, stress levels as high as 138 MPa and exposure times as long as 15,000 hours. The creep strains exhibit a complex behavior arising from the combined action of true creep and stress-affected precipitation of intermetallic phases. The latter process is suspected to be altered by neutron irradiation.

7882 **(INIS-BR—87) Hydrogen solid solutions in niobium - molybdenum single crystal alloys.** Silva, J.R.G. da; Ishikawa, T.T. (Sao Carlos Univ. (Brazil). Dept. de Engenharia de Materiais). (Sao Carlos Univ. (Brazil)). 1981. 13p. (In Portuguese). (CONF-8110302—1). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700211.

From 2. seminar on physical metallurgy and heat treatments; Rio de Janeiro, Brazil (1 Oct 1981).

The temperature variation of the hydrogen solubility in a series of single crystal Nb-Mo alloys ('binary solvents') in equilibrium with the gaseous phase at atmospheric pressure is presented. The partial thermodynamic properties of the interstitially dissolved hydrogen atoms were calculated from of solubility versus temperature curves. The hydrogen solution obeys the quasi-regular model at all the compositions of the investigated alloys. The variation of the partial enthalphy Hu sup(-) with the solvent alloys composition (Mo/Nb + Mo ratio) is compared with the variation of the electronic structure of the solvent. The non-random solute distribution in the binary solvent lattice is shown, with the H atoms prefering interstitial sites next to Nb atoms. (Author).

7883 **(INIS-BR—90) Solid solutions of hydrogen in niobium, molybdenum and their alloys.** Ishikawa, T.T. (Sao Paulo Univ., Sao Carlos (Brazil). Escola de Engenharia). 1981. 165p. (In Portuguese). NTIS (US Sales Only), PC A08/MF A01. Order Number DE84700212.

The solubility of hydrogen in niobium, molybdenum and niobium-molybdenum alloys with varying atomic fraction of molybdenum from 0.15 to 0.75 was measured on the temperature range of 673 °K to 1273 °k for one atmosphere hydrogen pressure. The experimental technique involved the saturation of the solvent metal or alloy with hydrogen, followed by quenching and analysis of the solid solution. The results obtained of hydrogen solubility are consistent with the quasi-regular model for the dilute interstitial solid solutions. The partial molar enthalpy and partial molar entropy in excess of the dissolved hydrogen atoms were calculated from data of solubility versus reciprocal doping temperature. The variation of the relative partial molar enthalpy of hydrogen dissolved in niobium-molybdenum alloys, with the increase of molybdenum content of the alloy was analized. (Author).

7884 **(INIS-mf—8297) Tunneling measurements in amorphous layers of superconducting transition metals: molybdenum, vanadium, and niobium.** Roll, U. (Technische Hochschule Aachen (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet). 2 Feb 1981. 79p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84700213.

Tunneling experiments with amorphous Molybdenum and Vanadium layers are presented, showing no significant increase of the reduced energy gap 2Δ(O)/kTsub(c)(Δ) compared with the BCS-value, in contrast to all previous measurement on amorphous superconducting materials of simple s-p-metals, showing on enhanced electron-phonon-interaction. This fact may lead to the conclusion that the strong electron-phonon coupling is caused by the amorphous structure of the superconductor. The present results, however, indicate that the strong electron-phonon interaction cannot be explained only ba the amorphous structure of the superconductor. In the measurements of the second derivative d^2U/dI^2 no phonon-induced structures have been observed for amorphous molybdenum, vanadium and niobium films. Apparently the phonon density of states F(ω) of amorphous transition metals has no structure, thus the longitudinal and transverse phonons cannot be identified in the measured (d^2U/dI^2)-curves. This particular behaviour of the amorphous transition metals in contrast to the simple s-p-metals may be interpreted by the strongly localized d-electrons. (orig./GG).

7885 (INIS-mf—8306, pp 303-312) **Joining techniques and non-destructive testing.** Ohrt, E.F. (Internationale Atomreaktorbau G.m.b.H. (INTERATOM), Bergisch Gladbach (Germany, F.R.)); Lison, R. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.)); Schuhmacher, D. (Rheinische Braunkohlenwerke A.G., Koeln (Germany, F.R.)). 1982. (In German). NTIS (US Sales Only), PC A16/MF A01. (CONF-820182—Vol.14).

From Seminar at the Minister for Economics, Trade and Transportation of the land of North Rhine Westphalia; Duesseldorf, F.R. Germany (14 Jan 1982).

In order to find suitable materials for high-temperature applications, the commercial alloys should always be examined with a view to the weldability and testing characteristics of the basic materials and welds. Welding characteristics of selected high-temperature materials have therefore been studied in a screening programme using the recommended welding fluxes in order to obtain a specification of joining techniques for suitable high-temperature materials. Simultaneously, the various methods of non-destructive testing have been tested in basic materials with different grain sizes, and a volumetric test of welds has been attempted. (orig.).

7886 (INIS-mf—8664, pp 23) **Investigations of crystal defects in metals with high melting point by field ion microscopy.** Krautz, E. (Technische Univ., Graz (Austria). Inst. fuer Festkoerperphysik); Haiml, G. (Vereinigte Metallwerke Ranshofen (Austria)). 1982. (In German). NTIS (US Sales Only), PC A05/MF A01. (CONF-8209185—).

From Annual conference of the Austrian Physical Society; Graz, Austria (22 Sep 1982).

7887 (INIS-mf—8664, pp 26) **Influence of additions on non-linear transport in $NbSe_3$.** Gruber, H. (Technische Univ., Graz (Austria). Inst. fuer Festkoerperphysik); Sassik, H. (Technische Univ., Vienna (Austria). 2. Inst. fuer Experimentalphysik). 1982. (In German). NTIS (US Sales Only), PC A05/MF A01. (CONF-8209185—).

From Annual conference of the Austrian Physical Society; Graz, Austria (22 Sep 1982).

7888 (INIS-mf—8664, pp 27) **Conductivity, magnetic susceptibility and optical DR-spectra of kappa-$Mo_{17}O_{47}$ with low additions of W, Re and V.** Gruber, H.; Krautz, E. (Technische Univ., Graz (Austria). Inst. fuer Festkoerperphysik); Gatterer, K.; Fritzer, H.P. (Technische Univ., Graz (Austria). Inst. fuer Physikalische und Theoretische Chemie). 1982. (In German). NTIS (US Sales Only), PC A05/MF A01. (CONF-8209185—).

From Annual conference of the Austrian Physical Society; Graz, Austria (22 Sep 1982).

7889 (INIS-mf—8664, pp 29) **Magnetic order and crystallographic distortion in the system U(Fesub(1-x)Mnsub(x))$_2$.** Groessinger, R.; Hilscher, G.; Kamesberger, J.; Sassik, H.; Wiesinger, G. (Technische Univ., Vienna (Austria). 2. Inst. fuer Experimentalphysik); Sechovsky, V.; Toul, J. (Karlsuniv., Prag (Czechoslovakia). Fakultaet fuer Mathematik und Physik). 1982. (In German). NTIS (US Sales Only), PC A05/MF A01. (CONF-8209185—).

From Annual conference of the Austrian Physical Society; Graz, Austria (22 Sep 1982).

7890 (INIS-mf—8664, pp 29) **Magnetic phase transformations in the systems (Hosub(x)Ysub(1-x))Co$_2$ und (Ndsub(x)Ysub(1-x))Co$_2$ (1 >= x >= 0.7).** Nowotny, H. (Technische Univ., Vienna (Austria). 1. Inst. fuer Theoretische Physik); Gratz, E. (Technische Univ., Vienna (Austria). 2. Inst. fuer Experimentalphysik). 1982. (In German). NTIS (US Sales Only), PC A05/MF A01. (CONF-8209185—).

From Annual conference of the Austrian Physical Society; Graz, Austria (22 Sep 1982).

7891 (INIS-mf—8664, pp 37) **Specific heat measurements at low temperatures in UNi$_2$.** Schmitzer, C.; Hilscher, G. (Technische Univ., Vienna (Austria). 2. Inst. fuer Experimentalphysik); Gmelin, E. (Max-Planck-Institut fuer Festkoerperforschung, Stuttgart (Germany, F.R.)). 1982. (In German). NTIS (US Sales Only), PC A05/MF A01. (CONF-8209185—).

From Annual conference of the Austrian Physical Society; Graz, Austria (22 Sep 1982).

7892 (INIS-mf—8664, pp 37) **Electronic structure of intermetallic Uranium 3-d compounds.** Schadler, G.; Hilscher, G.; Kirchmayr, H. (Technische Univ., Vienna (Austria). 2. Inst. fuer Experimentalphysik); Weinberger, P. (Technische Univ., Vienna (Austria). Inst. fuer Technische Elektrochemie). 1982. (In German). NTIS (US Sales Only), PC A05/MF A01. (CONF-8209185—).

From Annual conference of the Austrian Physical Society; Graz, Austria (22 Sep 1982).

7893 (INIS-mf—8664, pp 37) **Hydrogen absorption in Zr-Mn und Ti-Mn Laves phases.** Stampfl, H. (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H. Inst. fuer Physik); Hempelmann, R. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Festkoerperforschung); Hilscher, G.; Wiesinger, G.; Kirchmayr, H. (Technische Univ., Vienna (Austria). 2. Inst. fuer Experimentalphysik). 1982. (In German). NTIS (US Sales Only), PC A05/MF A01. (CONF-8209185—).

From Annual conference of the Austrian Physical Society; Graz, Austria (22 Sep 1982).

7894 (INIS-mf—8664, pp 38) **Influence of magnetic order on the thermal expansion in the intermetallic rare earth compounds.** Groessinger, R.; Gratz, E. (Technische Univ., Vienna (Austria). 2. Inst. fuer Experimentalphysik); Nowotny, H. (Technische Univ., Vienna (Austria). 1. Inst. fuer Theoretische Physik). 1982. (In German). NTIS (US Sales Only), PC A05/MF A01. (CONF-8209185—).

From Annual conference of the Austrian Physical Society; Graz, Austria (22 Sep 1982).

7895 (INIS-mf—8664, pp 38) **Temperature dependence of the Seebeck coefficient in metallic compounds with ferromagnetic order.** Adam, G. (Technische Univ., Vienna (Austria). 1. Inst. fuer Theoretische Physik); Gratz, E. (Technische Univ., Vienna (Austria). 2. Inst. fuer Experimentalphysik). 1982. (In German). NTIS (US Sales Only), PC A05/MF A01. (CONF-8209185—).

From Annual conference of the Austrian Physical Society; Graz, Austria (22 Sep 1982).

7896 (INIS-mf—8664, pp 39) **CeCu$_2$ - a Kondo system.** Gratz, E.; Mikovits, W.; Bauer, E.; Sassik, H.; Kirchmayr, H. (Technische Univ., Vienna (Austria). 2. Inst. fuer Experimentalphysik). 1982. (In German). NTIS (US Sales Only), PC A05/MF A01. (CONF-8209185—).

From Annual conference of the Austrian Physical Society; Graz, Austria (22 Sep 1982).

7897 **(KC—82/01d) High temperature materials and corrosion in combustion gases.** Jansen, P. (Korrosionscentralen, Glostrup (Denmark)). 1982. 29p. (In Danish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84750081.

Effect of alloying elements on resistance against oxidation and corrosion at temperatures above 500 degree C is presented for both ferritic and austenitic heat resisting steels and nickel alloys. Corrosion problems in both oxidizing and reducing sulfur containing gases are described. In the second part, three cases of high temperature problems are discussed. The problem of sulfidation of nickel in Ni-alloys and stainless steels is illustrated.

7898 **(LA-UR—83-3701) Influence of a plasma during laser welding.** Dixon, R.D.; Lewis, G.K. (Los Alamos National Lab., NM (USA)). 1983. Contract W-7405-ENG-36. 30p. (CONF-831195—4). NTIS, PC A03/MF A01. Order Number DE84004414.

From International congress on applications of lasers and electro-optics; Los Angeles, CA, USA (14 Nov 1983).

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High speed movies of single pulse laser welds are correlated with optical emission from the plasma and the acoustic wave to study and model enhanced coupling. The movies and acoustic signals combine to support enhanced coupling through the development of a laser supported combustion wave.

7899 **(LBL—13657) Ellipsometer studies of surface layers on lithium.** Schwager, F.; Geronov, Y.; Muller, R.H. (Lawrence Berkeley Lab., CA (USA)). Nov 1981. Contract AC03-76SF00098. 33p. (CONF-8010159—15). NTIS, PC A03/MF A01. Order Number DE84004344.

From Fall meeting of the Electrochemical Society; Hollywood, FL, USA (5 Oct 1980).

The growth of surface layers on lithium in propylene carbonate solutions can be followed by ellipsometry, although the refractive indices of many potential film materials are close to those of the electrolyte. Film thicknesses calculated from ellipsometer measurements increase over periods of several days at open circuit; they are several times larger than those derived from galvanostatic pulse measurements. Films are found to be inhomogeneous with properties continuously varying as a function of distance from the substrate; compact regions are located adjacent to the metal and porous regions adjacent to the solution. Electrode capacitance measurements are sensitive to the thin compact region which can also be generated by reaction with water vapor. Ellipsometer measurements are primarily affected by the thicker, porous region which may be formed by the precipitation of decomposition products of the solution.

7900 **(LBL—16536) Magneto-mechanical effects in 304 stainless steels.** Fultz, B.; Chang, G.M.; Kopa, R.; Morris, J.W. Jr. (Lawrence Berkeley Lab., CA (USA)). Aug 1983. Contract AC03-76SF00098. 13p. (CONF-830841—28). NTIS, PC A02/MF A01. Order Number DE84004343.

From Cryogenic engineering conference and international cryogenic materials conference; Colorado Springs, CO, USA (15 Aug 1983).

From an engineering standpoint, the effects of an 8 T magnetic field on the strength and fatigue crack growth rate of 304L and 304LN stainless steels at 77°K are small. Nevertheless, the work-hardening behavior of 304L is consistent with an increased amount of $\gamma \rightarrow \alpha'$ transformation in the presence of the magnetic field. It appears that both an increase in the amount of prior cold-work and an increase in the amount of carbon plus nitrogen in this material will cause the $\gamma \rightarrow \alpha'$ transformation to effect more work-hardening which does not contribute to the elongation of the mate-

rial. Preliminary data show that the effect of an 8 T magnetic field on the fatigue crack growth rates of 304L and 304LN at 77°K is barely measurable, but a decrease in the fatigue crack growth rate is suggested. In the opinion of the authors, a magnetic field of 8 T is a practical threshold for observing magneto-mechanical effects in 304 stainless steels. If 304 stainless steels are proposed as structural materials for superconducting magnets with higher operating fields, magneto-mechanical effects may become a subject of more engineering concern.

7901 (LBL—16897) **Design and characterization of Mn-Al-C alloys for permanent magnet applications.** Gau, J. (Lawrence Berkeley Lab., CA (USA)). Oct 1983. Contract AC03-76SF00098. 235p. NTIS, PC A11/MF A01. Order Number DE84004881.

Portions are illegible in microfiche products; Thesis.

Extrusion is the most effective means of developing a deformation texture which coincides with the easy axis of magnetization. However, severe deformation induces disordering and possibly a phase change. No Mn_3AlC precipitates were found except in the magnet alloyed with Cu. Second phase particles of Al_2O_3 dispersed in the ferromagnetic phase are identified. Catastrophic intergranular fracture is attributed to the enhancement of oxygen at grain boundaries and their high energetic state where the magnetic domain walls are pinned. The negative effect of Fe as an alloying element is due to its nonmagnetic behavior affecting the local atomic environment. The best properties with (BH)/sub max/ = 8.1 MGOe in the magnet containing 0.8 wt % Ni is attributed to the strong local Ni-Mn ferromagnetic coupling and improved magnetic anisotropy. Rapid solidification processing by melt spinning results in a new nonmagnetic hexagonal ordered phase. The Mn-Al-C magnetic powders having a coercivity of 1640 Oe and a magnetic moment of 55.7 emu/g were not suitable for magnetic recording. Magnetic properties of sintered magnets are inferior to those of extruded ones. The coercivity mechanism is as follows: magnetization reversal occurs by the combined processes of domain rotation impeded by magnetic anisotropy and irreversible domain wall motion pinned by various defects. Grain boundaries play the most significant role in pinning the domain walls.

7902 (NBSIR—83-1690, pp 11-39) **Martensitic transformations in Fe-Cr-Ni stainless steels.** Reed, R.P. (National Bureau of Standards, Boulder, CO). May 1983. NTIS, PC A19/MF A01.

In Materials studies for magnetic fusion energy applications at low temperatures - VI.

Very low-temperature martensitic transformations are of great concern of cryogenic applications and research. The principal transformation characteristics are reviewed and then elaborated. The materials classes or alloy systems that exhibit martensitic transformations at very low temperatures are briefly discussed, and references to reviews and compilations are given. The austenite stability of Fe-Cr-Ni alloys with regard to cooling, elastic stress, and deformation is discussed in detail, and the empirical stability expressions that have been developed are summarized and reviewed. Structural relationships between the face-centered cubic austenite (γ) and body-centered cubic (α') and hexagonal-close-packed (ϵ) martensite products are examined. Typical stress-strain curves of stable and metastable austenitic alloys are illustrated and analyzed as is the temperature dependence of the flow strength below room temperature. Finally, the influence of martensite transformation upon alloy performance in cryogenic applications is surveyed.

7903 (NBSIR—83-1690, pp 41-52) **Computer-interactive fatigue crack growth rate test procedure.** Cheng, Y.W. (National Bureau of Standards, Boulder, CO). May 1983. NTIS, PC A19/MF A01.

In Materials studies for magnetic fusion energy applications at low temperatures - VI.

A computer-interactive fatigue crack growth rate testing system has been developed that implements the fatigue crack growth rate testing procedure set forth in ASTM E647-81. The system uses a minicomputer to acquire the load-deflection data as a function of load cycles and to determine the crack length using the compliance technique. The fatigue crack growth rate, da/dN and the stress intensity range, ΔK, are calculated and plotted during the test.

7904 (NBSIR—83-1690, pp 53-71) **Effects of sensitization on some fracture mechanics fatigue parameters for Fe-18Cr-3Ni-13Mn-0.37N stainless steel at 295 and 4 K.** Tobler, R.L. (National Bureau of Standards, Boulder, CO). May 1983. NTIS, PC A19/MF A01.

In Materials studies for magnetic fusion energy applications at low temperatures - VI.

A nitrogen-bearing austenitic stainless steel (Fe-18Cr-3Ni-13Mn-0.37N) was subjected to fatigue tests at 295 and 4 K. Sensitization (chromium carbo-nitride precipitation) was induced by heating the as-received annealed material for 0.75 or 1.5 h at 977 K. Data comparisons for the sensitized versus the annealed conditions indicate that at 295 K there is little or no difference in the Paris law parameters governing fatigue crack growth rates at intermediate ΔK. At 4 K, however, sensitization reduces the fatigue resistance of this steel by adversely affecting all three stages of the fatigue process: crack initiation, crack propagation, and fatigue fracture toughness.

7905 (NBSIR—83-1690, pp 73-86) **Effects of magnetic field on tensile behavior at 4 K of alloys 304 and 310.** Reed, R.P.; Arvidson, J.M.; Ekin, J.W.; Schoon, R.H. (National Bureau of Standards, Boulder, CO). May 1983. NTIS, PC A19/MF A01.

In Materials studies for magnetic fusion energy applications at low temperatures - VI.

Experiments were conducted to assess the effects of a steady magnetic field on the austenite stress-strain characteristics at 4 K. Wire specimens (0.64-mm dia) of both a stable Fe-26Cr-20Ni (AISI 310) and metastable Fe-18Cr-9Ni (AISI 304) were measured. A 7-T magnetic field was produced by a split-pair NbTi superconducting magnet with radial access ports and the field was applied perpendicular to the tensile specimen axis. Tests were conducted at 4 K with the field off, with the field on, and with the field switched on and off after prescribed amounts of plastic deformation. The Young's modulus, tensile yield strength and tensile stress-strain curves were measured. The results are summarized here: (1) during magnetic field on/off experiments, no change in austenite flow strength of either alloy was observed from the application or absence of a 7-T field and (2) there was no detectable effect of a constant 7-T magnetic field on the yield strength and Young's modulus of either alloy. However, the specimen-to-specimen yield strength data scatter was large and the application of magnetic field would not necessarily produce changes of flow strength in excess of the data scatter. Discussion is also presented on magnetic field effects on discontinuous yielding and cold worked alloys.

7906 (NBSIR—83-1690, pp 87-112) **Factors influencing the low-temperature dependence of yielding in AISI 316 stainless steels.** Tobler, R.L.; Beckman, D.H.; Reed, R.P. (National Bureau of Standards, Boulder, CO). May 1983. NTIS, PC A19/MF A01.

In Materials studies for magnetic fusion energy applications at low temperatures - VI.

Tensile tests at temperatures between 323 and 4 K were performed on one heat of AISI 316 austenitic stainless steel having the composition Fe-17.34Cr-12.17Ni-1.55Mn-2.16Mo-0.051C. The temperature dependences of the yield and flow strengths at plastic stain increments from 0.2 to 3.65% are analyzed. At the yield strain (0.2%), no body-centered cubic (bcc) martensite phase transformation is detected. At higher strains ($\sim$ 3.2 +- 0.6%), bcc martensite forms from the parent austenite phase at test temperatures below 175 K, but there are no discontinuities in the temperature dependence of flow strength. A review of data available for three heats of AISI 316 at temperatures between 973 and 4 K reveals that deviations from thermally-activated plastic flow theory occur at temperatures below 175 K, apparently depending on heat-to-heat compositional variations. Grain size and magnetic transition effects on the yield strength are discussed.

7907 (NBSIR—83-1690, pp 113-126) **Temperature dependence of flow strength of selected austenitic stainless steels.** Reed, R.P.; Tobler, R.L.; Elmer, J.W. (National Bureau of Standards, Boulder, CO). May 1983. NTIS, PC A19/MF A01.

In Materials studies for magnetic fusion energy applications at low temperatures - VI.

It is important to characterize and to understand the temperature dependence of the tensile flow strength of austenitic steels for efficient design and material selection. Recent studies have suggested the possibility of three anomalies in the temperature dependence of the flow strength of Fe-Cr-Ni and Fe-Cr-Ni-Mn austenitic stainless steels. Reduction of flow strength at decreasing temperature may be associated with the onset of the austenite to martensite transformation (~ 200 K), the magnetic transition at the Neel temperature (~ 50 K) and low temperature dislocation dynamics (< 20 K). The tensile flow strength was investigated in the temperature range 4 to 295 K for two annealed polycrystalline alloys: Fe-20Cr-16Ni-6Mn-0.2N steel (produced in the USSR and independently tested by two research laboratories) and Fe-18Cr-10Ni-0.1N steel (AISI 304LN). The former alloy is stable with respect to strain-induced martensitic transformations, the latter metastable.

7908 (NBSIR—83-1690, pp 127-155) **Properties of austenitic stainless steel at cryogenic temperatures.** McHenry, H.I. (National Bureau of Standards, Boulder, CO). May 1983. NTIS, PC A19/MF A01.

In Materials studies for magnetic fusion energy applications at low temperatures - VI.

The low temperature behavior of austenitic stainless steels is reviewed with emphasis on three general classes: (1) the AISI 300-series in the annealed condition; (2) the nitrogen-strengthened grades; and (3) high-strength cold-rolled sheet of the AISI 300-series. Mechanical and physical properties of selected alloys in these classes are presented. Welding, the properties of weldments, and other fabrication considerations are discussed. Recent results on the influence of ferrite content, nitrogen, and sensitization on castings of composition similar to the AISI 300 series are also reviewed.

7909 (NBSIR—83-1690, pp 157-179) **Austenitic-steel elastic constants.** Ledbetter, H.M. (National Bureau of Standards, Boulder, CO). May 1983. NTIS, PC A19/MF A01.

In Materials studies for magnetic fusion energy applications at low temperatures - VI.

We review recent NBS studies on austenitic-stainless-steel elastic constants at low temperatures. By measuring velocities of longitudinal and shear waves, we determined accurately the usual engineering elastic constants: Young's modulus, shear modulus, bulk modulus (reciprocal compressibility), and Poisson's ratio.

7910 (NBSIR—83-1690, pp 181-194) **Elastic constants of an Fe-5Cr-26Mn austenitic steel, 76 to 400 K.** Ledbetter, H.M.; Austin, M.W. (National Bureau of Standards, Boulder, CO). May 1983. NTIS, PC A19/MF A01.

In Materials studies for magnetic fusion energy applications at low temperatures - VI.

By measuring longitudinal-mode and transverse-mode sound velocities at frequencies near 10 MHz, we determined the complete engineering elastic constants - bulk modulus, shear modulus, Young modulus, Poisson ratio - for an Fe-5Cr-26Mn austenitic steel between 76 and 400 K. Due to a magnetic transition, all elastic constants behave anomalously below about 360 K. The bulk modulus begins to soften during cooling at some higher temperature. Except for Poisson's ratio, below the 360-K magnetic transition, all elastic constants resume an apparently normal temperature dependence. After increasing abruptly at the magnetic transition, Poisson's ratio increases with decreasing temperature.

7911 (NBSIR—83-1690, pp 199-211) **Correlations of fatigue crack growth rate parameters at cryogenic temperatures.** Cheng, Y.W.; Tobler, R.L. (National Bureau of Standards, Boulder, CO). May 1983. NTIS, PC A19/MF A01.

In Materials studies for magnetic fusion energy applications at low temperatures - VI.

Fatigue crack growth rate data of ferritic steels, AISI 300 series stainless steels, and austenitic steel welds at 295, 76, and 4 K were collected and analyzed in terms of the exponent in the Paris equation. The data considered pertain to constant amplitude fatigue loading and stress ratio equal to 0.1. It is observed that there is a linear relation between log C and m, the parameters of the Paris equation. The exponent, m, is insensitive to the variation of fracture toughness and yield strength of the material except in low fracture toughness materials. Temperature effects on m are observed for ferritic steels but not for austenitic steels.

7912 (NBSIR—83-1690, pp 213-233) **Deformation and fracture of stainless steel castings and weldments at 4 K.** Whipple, T.A.; Brown, E.L. (National Bureau of Standards, Boulder, CO). May 1983. NTIS, PC A19/MF A01.

In Materials studies for magnetic fusion energy applications at low temperatures - VI.

A number of stainless steel weldments and castings that were deformed at 4 K have been examined with optical and electron microscopy. The purpose of this investigation was to assess the effects of residual delta-ferrite on the deformation and fracture mechanisms of these materials at cryogenic temperatures.

7913 (NBSIR—83-1690, pp 235-242) **Mechanical properties of stainless steel castings at 4 K.** Whipple, T.A.; McHenry, H.I. (National Bureau of Standards, Boulder, CO). May 1983. NTIS, PC A19/MF A01.

In Materials studies for magnetic fusion energy applications at low temperatures - VI.

Ten heats of cast CF8M stainless steel, which is the casting equivalent of AISI 316, were produced by a commercial vendor. In five of the heats the chromium and nickel contents were varied to obtain different delta-ferritie contents, ranging from 1.1 to 28.5 percent. The other five heats all had approximately 8 percent delta-ferrite and the nitrogen content was varied from 0.02 to 0.20 percent. As was expected from previous data on weldments and wrought materials, an increase in either delta-ferrite or nitrogen content increases the yield strength. In the five heats with varying nitrogen content the increase in strength resulted in a corresponding decrease in fracture toughness. An increase in delta-ferrite content also gave a decrease in fracture toughness up to approximately 15 percent dela-ferrite. Above this level the fracture toughness remained constant with increasing delta-ferrite content. This has been shown, by metallographic and fractographic evidence, to be due to the establishment of a continuous delta-ferrite crack path, at approximately 15 percent delta-ferrite.

7914 (NBSIR—83-1690, pp 243-271) **Metallography of duplex stainless steel castings.** Brown, E.L.; Whipple, T.A.; Krauss, G. (Colorado School of Mines, Golden). May 1983. NTIS, PC A19/MF A01.

In Materials studies for magnetic fusion energy applications at low temperatures - VI.

The metallography of duplex stainless steel castings was studied in a series of CF8M alloys with varying ferrite content. Various etching techniques were employed to facilitate microstructural characterization of primary and secondary structures by light microscopy. These observations were then correlated with transmission electron microscopy observations of substructure and selected area electron diffraction studies of the crystallography of the $\delta \rightarrow \gamma$ transformation. All alloys possessed a significantly recovered dislocation substructure in both the γ and δ phases which was correlated with certain microstructural features. The crystallography of the $\delta \rightarrow \gamma$ transformation was found to be consistent with a Kurdjumov-Sachs type orientation relationship regardless of apparent residual δ morphology. On the basis of these observations a model for the evolution of residual δ morphology was proposed.

7915 (NBSIR—83-1690, pp 273-338) **Transmission electron microscopy study of cast duplex austenitic stainless steels with varying ferrite content: as-cast and deformed at 4 K.** Brown, E.L. (Colorado School of Mines, Golden). May 1983. NTIS, PC A19/MF A01.

In Materials studies for magnetic fusion energy applications at low temperatures - VI.

The evolution of dislocation substructure and residual δ morphology in the as-cast state was studied by transmission electron microscopy and selected area electron diffraction in a series of CF8M alloys with varying ferrite content. Results were correlated with a previous light microscopy study. A well recovered dislocation substructure existed in both phases and was correlated with the $\delta \rightarrow \gamma$ transformation and thermal history. The lattice correspond-

ence observed by electron diffraction and habit planes of facets in the δ/γ interfacial morphology were consistent with a model based on a semicoherent interface. All results were consistent with a proposed model for evolution of residual δ morphology analogous to the proeutectoid $\gamma \rightarrow \alpha$ transformation. The evolution of substructure was detailed in 17.2 volume percent and 28.5 volume percent alloys that were strained at 4 K. Low strain specimens were characterized by dislocation generation in both phases in the vicinity of the δ/γ interface, dislocation-dislocation interactions and dislocation-sub-boundary interactions in γ. Later stages displayed formation and intersection of shear/deformation bands in γ and was followed by α' formation at the intersections. Bands of dislocations formed in the δ followed by deformation twinning in that phase. The results of γ deformation were considered in light of current theories of the strain-induced $\gamma \rightarrow \alpha'$ transformation and work hardening in metastable γ in addition to theories regarding plastically non-homogeneous alloys.

7916 (NBSIR—83-1690, pp 339-356) **Texture in stainless-steel welds: an ultrasonic study.** Lebetter, H.M.; Austin, M.W. (National Bureau of Standards, Boulder, CO). May 1983. NTIS, PC A19/MF A01.

In Materials studies for magnetic fusion energy applications at low temperatures - VI.

We studied texture effects in five AISI 316-stainless-steel welds. We measured nine independent ultrasonic velocities along the weld's principal axes. These velocities reveal a strong texture different from the <100>-fiber-type usually attributed to these materials. The texture is independent of delta-ferrite content and must contain a strong <110> element related to the fcc monocrystal elastic constant $C' = (C_{11}-C_{12})/2$. A postulated ideal (001)[110] plate-type texture explains the range of measured longitudinal and transverse sound velocities, but not their detailed values.

7917 (NBSIR—83-1690, pp 415-427) **Orthotropic elastic constants of a glass-fiber-cloth epoxy-matrix composite.** Ledbetter, H.M.; Austin, M.W. (National Bureau of Standards, Boulder, CO). May 1983. NTIS, PC A19/MF A01.

In Materials studies for magnetic fusion energy applications at low temperatures - VI.

We report the complete orthotropic-symmetry elastic-constant tensor for a laminated glass-fiber-cloth epoxy-matrix composite. Using a Marx-oscillator method, we determined the velocities of extensional (Young-modulus) waves in seven directions in each of the principal orthogonal planes. By a similar method, we determined velocities of torsional waves along the three principal orthogonal axes. From these twenty-two measurements, we deduced the nine-component S/sub ij/ elastic-compliance matrix. By matrix inversion we computed the C/sub ij/ elastic-stiffness matrix. Unexpected results for a shear modulus and for some Poisson's ratios suggest excessive fiber waviness in the fill direction.

7918 (ORNL—5995) **Mechanical properties of a modified 2 1/4 Cr-1 Mo steel for pressure vessel applications.** Klueh, R.L.; Swindeman, R.W. (Oak Ridge National Lab., TN (USA)). Dec 1983. Contract W-7405-ENG-26. 41p. NTIS, PC A03/MF A01. Order Number DE84004105.

Tensile and creep properties were determined on a V-Ti-B-modified 2 1/4 Cr-1 Mo steel considered to be a candidate alloy for pressure vessel aplications for coal liquefaction. The modified 2 1/4 Cr-1 Mo steel had about 0.2% V added for improved elevated-temperature strength and 0.02% Ti for grain refinement. Boron was added to improve the hardenability, thus allowing thicker sections to be quenched and normalized to completely bainitic microstructures. Lower carbon and silicon concentrations were used (~ 0.1% C and 0.02% Si) than in standard 2 1/4 Cr-1 Mo steel. The mechanical properties determined on the modified steel after a heat treatment typical for SA-387, grade 22, class 2, indicated high toughness and excellent elecated-temperature tensile and creep strength. The modified steel had substantially better stress-rupture properties than did a standard 2 1/4 Cr-1 Mo steel (both with bainitic microstructures) with equivalent tensile properties - especially at the lowest stresses and highest temperatures. The modified steel had toughness properties superior to those of the standard 2 1/4 Cr-1 Mo steel. Comparative transmission electron microscopy studies of the standard and modified 2 1/4 Cr-1 Mo steels indicated that the differences involve the carbide precipitates and the dislocation substructures present in the steels.

7919 (PNL-SA—11436) **Development of the amorphous phase in NiTi during heavy ion or electron bombardment.** Brimhall, J.L.; Kissinger, H.E.; Pelton, A. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1983. Contract AC06-76RL01830. 7p. (CONF-831174—53). NTIS, MF A01. Order Number DE84004845.

From Materials Research Society annual meeting; Boston, MA, USA (14 Nov 1983).

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A supralinear dose dependence for the amorphous transformation was observed in NiTi during bombardment with 2.5 MeV Ni^+ ions. These results are consistent with a mechanism that requires cascade overlap to obtain a critical defect density for the amorphous transformation. Direct amorphization in the cascades was not resolvable. The temperature dependence of the minimum dose required for complete amorphous transformation had the same form as that observed for amorphization of silicon. Amorphization caused by electron bombardment required a higher dose than by ion bombardment. Different degrees of homogeneity of the damage state between ions and electrons can explain the dose dependence on particle type.

7920 (RCO—6) **Proceedings of the sixth international workshop on rare earth-cobalt permanent magnets and their applications, August 31 - September 2, 1982, and third international symposium on magnetic anisotropy and coercivity in rare earth-transition metal alloys, September 3, 1982.** Fidler, J. (Technische Univ., Vienna (Austria). Inst. fuer Allgemeine Physik) (ed.). (Technische Univ., Vienna (Austria)). 1982. 3p. (CONF-8208161—; CONF-8209186—). NTIS (US Sales Only), PC A99/MF A01. Order Number DE84700208.

From 6. international workshop on rare earth-cobalt permanent magnets and their applications; Baden, Austria (31 Aug 1982).

Paper copy only, copy does not permit microfiche production. international workshop on rare earth-cobalt permanent magnets and their applications, Baden, Austria, 3, September 1982.

The first part (workshop) is concerned specifically with applications of rare earth-cobalt permanent magnets. The session headings are 1) electro-mechanical applications 2) electronic and miscellaneous applications 3) magneto-mechanical applications plus workshop on measurement methods 4) new materials and processes 5) industrial applications of REPM and future aspects. The second part (symposium) is concerned with physical properties of specific rare earth-transition metal alloys. (G.Q.).

7921 (RCO—6, pp 177-188) **Temperature characteristic of R-Co magnets.** Yi Quanrui; Sen Daku; Hun Hanchun; Ho Chunine (Southwest Inst. of Applied Magnetics, Mianyang, Sichuan (China)). 1982. NTIS (US Sales Only), PC A99/MF A01. (CONF-8208161—).

From 6. international workshop on rare earth-cobalt permanent magnets and their applications; Baden, Austria (31 Aug 1982).

The change of magnetic characteristics of sintered SmPrCo5(YX24,(BH)max=24MG.Oe) and Sm2(CoFeCuZr)17(YX30,(BH)max=30MG.Oe) magnets after being exposed to air for periods of up to 2400 hrs at temperature of 200°C, and dipped in liquid nitrogen (-196°C) for periods of up to 85 hrs have been studied. The remanent flux of both magnets in liquid nitrogen and in air at 200°C, again returned to room temperature were measured respectively. The result indicates that the remanent flux of both magnets increased about 5-10 percent for being exposed to liquid nitrogen, but there is a difference between the changes of the magnetic characteristics for both magnets. After returned to room temperature the remanent flux of SmPrCO5 magnet decreased more, it is about 20-30 percent. Whereas, there is no change for the remanent flux and intrinsic coercive force of Sm2(COCuFeZr)17 magnet. Therefore, it is a satisfaction for the application of Sm(COFeCuZr)17 in microwave devices in lower temperatures. (Author).

7922 (RCO—6, pp 319-327) **Some properties of high-coercivity 2:17 magnets.** Ervens, W. (Friedr. Krupp GmbH, Essen (Germany, F.R.)). 1982. NTIS (US Sales Only), PC A99/MF A01. (CONF-8208161—).

From 6. international workshop on rare earth-cobalt permanent magnets and their applications; Baden, Austria (31 Aug 1982).

Magnetization behaviour and thermal long-term stability of high-coercivity SmCo-2:17 magnets with sub(J)Hsub(C) > 1760 kA/m (22 kOe), sub(B)Hsub(C) > 720 kA/m (9 kOe) and (BH)sub(max) >= 215 kJ/m³ (27 MGOe) were examined at temperatures of up to 400° C. In their magnetization characteristics, high-coercivity 2:17 magnets differ from $SmCo_5$ and from the low-coercivity 2:17 material. At ambient temperature complete magnetization requires fields of >= 4800 kA/m (60 kOe) whereas at 400° C fields of only 2000 kA/m (25 kOe) are required. High-coercivity 2:17 magnets display better ageing behaviour than $SmCo_5$ and can be subjected to continuous operation at temperatures of up to 300° C. (Author).

7923 (RCO—6, pp 329-339) **Homogeneity of rare earth-cobalt magnets.** Gnehm, C.G. (Ugimag Recoma AG (Switzerland)); Haberer, J.P. (Aimants Ugimag S.A. (France)). 1982. NTIS (US Sales Only), PC A99/MF A01. (CONF-8208161—).

From 6. international workshop on rare earth-cobalt permanent magnets and their applications; Baden, Austria (31 Aug 1982).

The homogeneity aspect is of special interest to the REPM's because the coercivity, as a structure-sensitive property, is utilized dynamically on a level which is much higher than for any other previously known permanent magnet materials. When ring-shaped configurations of bare magnets are used in bearings or beam-focussing devices, the importance of symmetrical behaviour is well known. Based on the structural coercivity are unavoidable, but the limits are pushed further with the practical approach of most precise control of all materials and processing parameters in the powder-metallurgical manufacture. (Author).

7924 (RCO—6, pp 341-355) **Development and production of rare earth-cobalt permanent magnet alloys.** Velicescu, M. (Th. Goldschmidt AG, Essen (Germany, F.R.)). 1982. NTIS (US Sales Only), PC A99/MF A01. (CONF-8208161—).

From 6. international workshop on rare earth-cobalt permanent magnets and their applications; Baden, Austria (31 Aug 1982).

This is a review paper of recent developments of rare earth-cobalt permanent magnet alloys (REPM alloys). The most important REPM alloys with their compositions and their magnetic hardness mechanisms are summarized. Metallurgical aspects of the alloy production are presented. High magnetic energy products have been achieved in the last years in the laboratory as well for 2:17 two-phase precipitation hardened, sintered low oxygen processing methods. Energy products higher than 200 kJ/m³ (=25 MGOe) were measured on magnets produced from Goldschmidt's (SmPr)Co_5 and (SmPrNd)Co_5 powders. (Author).

7925 (RCO—6, pp 357-372) **Developments in bonded rare earth permanent magnets.** Johnson, R.E.; Wetherilt, A.J. (Preformations (Magnets) Limited, Swindon, Wiltshire (United Kingdom)). 1982. NTIS (US Sales Only), PC A99/MF A01. (CONF-8208161—).

From 6. international workshop on rare earth-cobalt permanent magnets and their applications; Baden, Austria (31 Aug 1982).

The various factors affecting the thermal stability of rare earth bonded magnets are re-examined by analysing the behaviour of second quadrant demagnetisation curves. It is shown that oxygen adsorbed onto the alloy particle surface is the principal cause of the gradual diminution of the magnetic properties although the choice of bonding medium can be important. Precipitation hardened alloys are shown to exhibit enhanced thermal stability over the 1:5 types. In view of these results recent improvements in the stability of production material are noted. (Author).

7926 (RCO—6, pp 373-383) **Aging behaviour of some polymer bonded magnets.** Evans, J.; Kianvash, A.; Harris, I.R. (Birmingham Univ. (United Kingdom). Dept. of Physical Metallurgy and Science of Materials); Nyholm, P.S. (Raychem Corp., Swindon (United Kingdom)). 1982. NTIS (US Sales Only), PC A99/MF A01. (CONF-8208161—).

From 6. international workshop on rare earth-cobalt permanent magnets and their applications; Baden, Austria (31 Aug 1982).

The paper reports a study of the permanent deterioration in the magnetic properties of some polymer bonded magnets as a function of aging in air at elevated temperatures (typically 150 °C). The magnetic alloys employed in these studies were of the types Smsub(1-x)MMsub(x)Co_5 and Sm(Co,Fe,Cu,Zr)sub(z), where z=8.92; these were designated 1:5 and 2:17 type respectively. The substitution of Sm by MM in the 1:5 alloys had little effect on the stability of the magnets at elevated temperatures. The permanent deterioration in the magnetic properties of the 1:5 magnets on aging at elevated temperatures has been attributed largely to the oxidation of the rare earth-cobalt powders due to both trapped oxygen and the ingress of atmospheric oxygen. The 2:17 type magnets were found to be much more stable at elevated temperatures. (Author).

7927 (RCO—6, pp 385-397) **Aging characteristics of resin-bonded $SmCo_5$ and Sm_2Co_{17}-type magnets.** Cremer, R.J.; Reppel, W. (Vacuumschmelze GmbH, Hanau (Germany, F.R.)); Demmel, F. (Siemens AG, Erlangen (Germany, F.R.)). 1982. NTIS (US Sales Only), PC A99/MF A01. (CONF-8208161—).

From 6. international workshop on rare earth-cobalt permanent magnets and their applications; Baden, Austria (31 Aug 1982).

The long-term stability of epoxy-resin bonded $SmCo_5$ and $Sm_2(Co, Fe, Cu, Ti)_{17}$-type magnets was measured in the temperature range upt to 130 °C. The deterioration of magnetic properties, especially of the intrinsic coercive force, with temperature and time can be largely reduced by using precipitation-hardened Sm(Co, Fe, Cu, Ti)sub(6.9) alloys with coarser particle size instead of $SmCo_5$ alloy for the magnetic constituent of bonded magnets. (Author).

7928 (RCO—6, pp 399-409) **Improvement of coercivity of (CeMM,Sm)Co_5-magnets.** Rodewald, W. (Vacuumschmelze GmbH, Hanau (Germany, F.R.)); Fidler, J. (Techn. Univ., Vienna (Austria). Inst. fuer Allgemeine Physik). 1982. NTIS (US Sales Only), PC A99/MF A01. (CONF-8208161—).

From 6. international workshop on rare earth-cobalt permanent magnets and their applications; Baden, Austria (31 Aug 1982).

The coercivity of (CeMM,Sm)Co_5-magnets can be improved by additions of small amounts of transition metal powders, e.g. Sn, Pb, Zn, Fe, Co, Ni, etc., in combination with one of the hydrides, TiH_3, ZrH_3, NbH etc, or powders of alloys, e.g. Fe_2Sn, Ni_3Sn_2, etc. and ZrH_2. The increase of coercivity is mainly caused by the impediment of phases with low anisotropy which can act as nucleation centres for reversed domains. This is demonstrated by investigations in a transmission electron microscope. (Author).

7929 (RCO—6, pp 411-419) **Microstructural aspects of some samarium-cobalt alloys.** King, C.E.; Harris, I.R. (Birmingham Univ. (United Kingdom). Dept. of Physical Metallurgy and Science of Materials); Murphy, D.W.A.; Kennedy, D. (Rare Earth Products Ltd., Widnes (United Kingdom)). 1982. NTIS (US Sales Only), PC A99/MF A01. (CONF-8208161—).

From 6. international workshop on rare earth-cobalt permanent magnets and their applications; Baden, Austria (31 Aug 1982).

This paper reports the results of an investigation into the effects of casting conditions and of melt additions on the microstructure of some $SmCo_5$ alloys used in sintered and polymer bonded magnet production. These studies show extensive grain growth in the rapidly cooled 1:5 alloy which has been attributed to a massive transformation in this alloy under these conditions. This grain growth was not observed for the slow cooled sample or for the SmCosub(4.8) diagram. The addition of Sm_2O_3 to the 1:5 melt also inhibited the phase transformation. (Author).

7930 (RCO—6, pp 421-431) **Role of grain size in magnetic properties of 1:5 type RECo magnets.** Kocso, I.; Pataki, B.; Solymar, M.; Buzas, A. (Research Inst. for Ferrous Metallurgy, Budapest (Hungary)). 1982. NTIS (US Sales Only), PC A99/MF A01. (CONF-8208161—).

From 6. international workshop on rare earth-cobalt permanent magnets and their applications; Baden, Austria (31 Aug 1982).

The effect of grain size between 3.5 and 4.4 μm on the main technical magnetic properties of the $SmCo_5$ magnets was studied. The sintering temperature was changed in about 10 °C increments between 1085-1110 °C. Optimum values were obtained at low sintering temperature near the 4 μm grain size. However, with the increase of the sintering temperature good magnetic properties can be achieved within the full grain size range studied. The structures obtained with the varioius types of sintering were tested with SEM, microprobe and optical methods. In addition to the $RECo_5$, RE_2Co_7 and RE_2Co_{17} phases in the specimens sintered at higher temperatures RE enrichment was experienced in certain phase elements. (Author).

7931 (RCO—6, pp 433-443) **2-17 rare earth-cobalt permanent magnets with coercive force up to 30 KOe.** Sun Tianduo (Central Iron and Steel Research Institute, Beijing (China)). 1982. NTIS (US Sales Only), PC A99/MF A01. (CONF-8208161—).

From 6. international workshop on rare earth-cobalt permanent magnets and their applications; Baden, Austria (31 Aug 1982).

Sintered Sm(Cosub(.67)Cusub(.08)Fesub(.22)Zrsub(.03))sub(z) (Z=7.7-8.9) magnets with high coercive force have been prepared. The experiments showed that the important factors controlling magnetic hardness are mainly the amount of liquid phase additive, aging time at 820 °C and step treatment. Both coercivity and squareness of loops for the liquid phase sintered magnets appear to be much higher than those for the magnets without additive. It is specially interesting that the primary magnetization curves for the magnets described here show a behaviour different from that of the typical 2-17 magnets. In the present paper, both maximum sub(m)Hsub(c) of 33 KOe and maximum (BH)sub(max) of 27 MGOe have been obtained. The magnets are not easy to be magnetized to saturation even in a magnetic field up to 50KOe. (Author).

7932 (RCO—6, pp 445-455) **Mechanical deformation of sintered rare earth permanent magnets.** Bond, S.M.; Wetherilt, A.J.; Johnson, R.E. (Preformations (Magnets) Ltd.,Swindon, Wiltshire (United Kingdom)). 1982. NTIS (US Sales Only), PC A99/MF A01. (CONF-8208161—).

From 6. international workshop on rare earth-cobalt permanent magnets and their applications; Baden, Austria (31 Aug 1982).

The deformation of sintered samarium cobalt material has been studied as a function of applied pressure, temperature and time. Arc segments manufactured by this technique apparently exhibit true radial orientation. (Author).

7933 (RCO—6, pp 457-468) **Oxidation behavior of rare-earth magnet alloys.** Strnat, R.M.W. (Dayton Univ., Ohio (USA). Research Inst.); Luo, H.-L. (California Univ., San Diego (USA)). 1982. NTIS (US Sales Only), PC A99/MF A01. (CONF-8208161—).

From 6. international workshop on rare earth-cobalt permanent magnets and their applications; Baden, Austria (31 Aug 1982).

An investigation of the aging characteristics of several REPM-type hard magnetic materials is described. Oxidation curves based on a thermogravimetric study are presented. Powders and magnets were exposed to dry air at 120 °C up to approximately 8000 hours. The samples included several specially prepared $MMCo_5$ alloys and sintered bodies, commercial alloy powders of $SmCo_5$, $PrCo_5$, and $CeMMCo_5$, and two commercial sintered precipitation-hardened magnet types - $Ce(Co,Fe,Cu)_5$ and $Sm_2(Co, Cu, Fe, Zr)_{17}$. Long-term magnetic aging was also investigated. Flux loss and changes in coercive force as a function of time at 120 °C to 1000 hours exposure are reported. Demagnetization curves, measured on massive samples before and after approximately 1000 hours of aging, are shown. Results are reported for magnet samples with both high (approximately 7.4 g/cm³) and relatively low (approximately 6.4 g/cm³) sintered density. Test conditions and procedures are described. (Author).

7934 (RCO—6, pp 469-477) **Air aging of rare earth-cobalt matrix magnets.** Strnat, R.M.W. (Dayton Univ., OH (USA). Research Inst.); Liu, S. (Beijing Univ. of Iron and Steel Technology, Peking (China)). 1982. NTIS (US Sales Only), PC A99/MF A01. (CONF-8208161—).

From 6. international workshop on rare earth-cobalt permanent magnets and their applications; Baden, Austria (31 Aug 1982).

Additional data on the aging of bonded matrix magnets are presented. Flux loss characteristics of three commercial polymer-bonded magnet types and a solder-matrix magnet with Sm(Co, Cu, Fe, Zr) sub(approximately 7.4) are reported. Samples were exposed to dry air at constant elevated temperatures ranging from 50 °C to 150 °C (in 25 ° intervals) for approximately 8000 hours. Changes of the open-circuit remanent flux (OCRF) as a function of exposure time at each temperature are reported. Second quadrant demagnetization curves were plotted before and after aging. Representative curves are shown and discussed with respect to purely magnetic and to microstructure-related changes during aging. 2-17 magnet samples continue to display significantly lower aging losses than the 1-5's. At temperatures above 100 °C, the matrix material also strongly affects the stability of precipitation-hardened 2-17 based magnets. Samples with a soft-metal Pb-Sn binder age at about 1/3 the rate of an epoxy-bonded 2-17 magnet type tested. The OCRF of these metal matrix magnets is reduced by about 2 % at 100 °C, 3 % at 125 °C, 4 % at 150 °C in 8000 hours aging. Only relatively minor loop shape deterioration is observed in the metal-matrix magnet demagnetization curves. (Author).

7935 (RCO—6, pp 479-484) **Recent developments in the field of rare earth magnets and their uses in the USA.** Strnat, K.J. (Dayton Univ. (USA). Electrical Engineering Dept.). 1982. NTIS (US Sales Only), PC A99/MF A01. (CONF-8208161—).

From 6. international workshop on rare earth-cobalt permanent magnets and their applications; Baden, Austria (31 Aug 1982).

Some efforts in the USA in the last few years are summarized. Application development was in the foreground. New machine and device designs have evolved and are now in production or ready for it. Magnet manufacturing process improvements have yielded higher-energy $SmCo_5$. Some unconventional production methods are being explored. Better internally temperature-compensated magnets and more stable matrix magnets were developed. Extensive property characterization was performed. Physical origins of the magnetic hardness were studied. Little work on new alloys was done in recent years. (Author).

7936 (RCO—6, pp 511-522) **Development and research on permanent magnets in the People's Republic of China.** Ho Wen-Wang (Peking Univ. (China). Dept. of Physics). 1982. NTIS (US Sales Only), PC A99/MF A01. (CONF-8208161—).

From 6. international workshop on rare earth-cobalt permanent magnets and their applications; Baden, Austria (31 Aug 1982).

As an introductory talk, the status of research and production level of permanent magnetic materials in China are briefly presented. The best magnetic properties of Alnico VIII are Br = 11500 to 11700 Gs, Hc = 1510 to 1530 Oe, (BH)sub(m) = 12.6 to 13.5 MGOe. Then the recent development of research and production of new magnetic materials, including rare earth-cobalt permanent magnets and Fe-Cr-Co alloys, are reviewed. China is abundant in rare-earth resources, this is a favourable factor for the development of rare earth-cobalt permanent magnets. We have devoted much attention to the development of and research on rare earth-cobalt permanent magnets, so the main part of this paper is concerned with them. Some further research on these magnets are listed. (Author).

7937 (RCO—6, pp 599-608) **Development of the cellular microstructure in the Sm Cosub(7.4)-type magnets.** Rabenberg, L.; Mishra, R.K.; Thomas, G. (Lawrence Berkeley Laboratory, Berkeley (United States of America)). 1982. NTIS (US Sales Only), PC A99/MF A01. (CONF-8209186—).

From 3. international symposium on magnetic anisotropy and coercivity in rare earth-transition metal alloys; Baden, Austria (3 Sep 1982).

Sm (Co, Cu, Fe, Zr)sub(7.4) alloys, annealed at 1160-1200 °C and quenched, are shown to consist of a heavily faulted hexagonal structure which provides ample sites for easy nucleation of the $SmCo_5$ phase. It is argued that the development of the cellular microstructure consisting of twinned rhombohedral Sm_2Co_{17} cells and hexagonal $SmCo_5$ cell boundaries on pyramid planes occurs by diffusionless transformation of the hexagonal Sm_2Co_{17} phase to the rhombohedral Sm_2Co_{17} phase and subsequent diffusional growth of the $SmCo_5$ phase. (Author).

7938 (RCO—6, pp 643-654) **Amorphous Smsub(1-x)Cosub(x)-films and their applications.** Gronau, M. (Ruhr-Univ., Bochum (Germany, F.R.)). 1982. NTIS (US Sales Only), PC A99/MF A01. (CONF-8209186—).

From 3. international symposium on magnetic anisotropy and coercivity in rare earth-transition metal alloys; Baden, Austria (3 Sep 1982).

The hysteresis properties and the magnetization reversal behavior of amorphous Smsub(1-x)Cosub(x)-films ($0.7 <= x <= 0.9$) with induced inplane uniaxaial magnetic anisotropy are analyzed with respect to their dependences on Co-concentration, film thickness and preparation parameters. Possible applications are discussed. (Author).

7939 (RCO—6, pp 667-675) **Effect of heat treatment on the microstructure and magnetic properties of a Sm(Co,Fe,Cu,Zr)sub(7.2) magnet.** Hadjipanayis, G.C.; Hazelton, R.C.; Wollins, S.H. (Kollmorgen Corporation, Hartford (United States of America)); Wysierkierski, A. (Sheritt Gordon Mines Ltd., Fort Saskatchewan, Alberta (Canada)); Lawless, K.R. (Virginia Univ., Charlottesville (United States of America)). 1982. NTIS (US Sales Only), PC A99/MF A01. (CONF-8209186—).

From 3. international symposium on magnetic anisotropy and coercivity in rare earth-transition metal alloys; Baden, Austria (3 Sep 1982).

The magnetic properties of a TDK REC-26 magnet have been correlated with the microstructure development at various stages of the heat treatment. Transmission electron microscope studies on the as-received magnets show 1:3 phase thin lamellae superimposed on a 'cellular microstructure'. The cells have the 2:17 rhombohedral phase and they are surrounded by coherent 1:5 hexagonal boundaries. This kind of microstructure develops during the 815 °C heat treatment and does not change in the subsequent slow cooling. This is in contrast to the magnetic properties which change drastically during the heat treatment. Preliminary x-ray energy dispersive analysis studies show a change in the Cu content of cell interiors and cell boundaries during the slow cooling. Such a change would lead to a domain wall energy gradient across the cell boundary and therefore to high coercivity. (Author).

7940 (RCO—6, pp 677-692) **Aging phenomena of $SmCo_5$ permanent magnets at 20 °- 740 °C.** Xie Hong-zu; Cheng Min-jie; Lian Shang-lan (Batou Research Inst. of Metallurgy, Baotou (China)); He Yuan-jin; Yu Wei-thung; Xiong Jia-jiong (Quinghua Univ., Beijing (China)). 1982. NTIS (US Sales Only), PC A99/MF A01. (CONF-8209186—).

From 3. international symposium on magnetic anisotropy and coercivity in rare earth-transition metal alloys; Baden, Austria (3 Sep 1982).

Investigation into the aging phenomena of liquid sintered $SmCo_5$ permanent magnets at 20 ° - 740 °C has been carried out by using positron annihilation technique (PAT), electron microscopy, electric resistance and magnetic measurements. It has been found that a more complex aging process at 20 ° - 450 °C, in particular between 20 ° and 150 °C, which is caused by the change of vacancy clusters and other lattice imperfections such as interstitial atoms and atom disorders, and also by the precipitation of Sm_2Co_7/Sm_2Co_{17} phases in the $SmCo_5$ permanent magnets. The aging process so occured will affect the type, distribution and physical properties of pinning or nucleation centres, which in turn influence the demagnetization process and the properties of $SmCo_5$ magnets at elevated temperatures. (Author).

7941 (RCO—6, pp 693-708) **Reversible changes of coercivities and the microstructure of Sm(Co, Cu, Fe, Zr)sub(7.4) alloy during multiple step aging.** Chou Sochen Wang Run; Sun Guanfei (Beijing Univ. of Iron and Steel Technology (China)). 1982. NTIS (US Sales Only), PC A99/MF A01. (CONF-8209186—).

From 3. international symposium on magnetic anisotropy and coercivity in rare earth-transition metal alloys; Baden, Austria (3 Sep 1982).

The reversible changes of coercivities and the microstructure and magnetic domain structure of Sm(Co, Cu, Fe, Zr)sub(7.4) alloy during multiple step aging had been studied by transmission electron microscopy, microelectron-diffraction, magnetic-optical kerr effect, magnetic measurement as well as X-ray diffraction. It is found that the cellular structure is formed in the 1st step aging. The 2:17 structure has been found in the cell interior and 1:5 structure at cell boundaries. This structure remains unchanged in subsequent step aging at lower temperature, although the increase of coercivity from 2.8KOe to 5.4KOe is to be found. This may be due to the increase of difference in domain wall energies between the two phases. The reversible changes of coercivities show that the process of the multiple step aging is mainly variance of composition in both phases which is determined by atomic diffusion. (Author).

7942 (RCO—6, pp 709-720) **Development of 2-17 magnets.** Sun Daku; Hun hanthun; He Chuning (Southwest Inst. of Applied Magnetics, Miangang, Sichuan (China)). 1982. NTIS (US Sales Only), PC A99/MF A01. (CONF-8209186—).

From 3. international symposium on magnetic anisotropy and coercivity in rare earth-transition metal alloys; Baden, Austria (3 Sep 1982).

The development of the 2-17 type of rare earth cobalt permanent magnets is briefly reviewed. The research and production of the magnets and our achievements in SIAM are presented. Five YX series of 1-5 type with (BH)sub(m)=15 approximately 26MG'Oe and 2-17 type with (BH)sub(m) = 25 approximately 31 MG'Oe can be produced for users at present. The investigation for obtaining high coercivity and improving energy product of $Sm_2(Co, Cu, Fe, Zr)_{17}$ has been done. It was found that magnets with sub(j)Hsub(c) approximately= 20KOe; sub(B)Hsub(c) approximately= 10 Oe; (BH)sub(m) = 30 approximately 33MG'Oe can be obtained when Cu content is decreased while Fe and Zr contents are controlled in a proper range and the sametimes annealing time at the step of high temperature of multi-step should be prolonged. (Author).

7943 (RCO—6, pp 769) **Hysteresis and microstructure in sintered $SmCo_5$ magnets.** Kuntze, K. (TEW Magnetfabrik, Dortmund (Germany, F.R.)). 1982. NTIS (US Sales Only), PC A99/MF A01. (CONF-8209186—).

From 3. international symposium on magnetic anisotropy and coercivity in rare earth-transition metal alloys; Baden, Austria (3 Sep 1982).

The influence of second phases in sintered $SmCo_5$ magnets on nucleation of reversed domains at RT after various heat treatments is analysed by magnetic measurements and microscopic observation with Kerr effect. (Author).

7944 (RCO—6, pp 1-8) **Application of rare earth-cobalt permanent magnets to electromechanical devices.** Campbell, P. (Patscenter International, Princeton, New Yearsey (USA)). 1982. NTIS (US Sales Only), PC A99/MF A01. (CONF-8208161—).

From 6. international workshop on rare earth-cobalt permanent magnets and their applications; Baden, Austria (31 Aug 1982).

The Rare Earth-Cobalt permanent magnet has revolutionized the design of many electromechanical devices, and this paper attempts to get into focus the actual benefits to be gained in comparison to alnicos and ferrites. Practical operating conditions for each magnet type are considered, with the result that REPMs appear more attractive than on the basis of maximum energy density alone. Benefits of using REPMs can come in many different ways, depending upon the device and design constraints. (Author).

7945 (RCO—6, pp 9-20) **High energy density rare earth-cobalt magnets.** Semones, B.C. (Kollmorgen Corp., Hartford, CT (USA)). 1982. NTIS (US Sales Only), PC A99/MF A01. (CONF-8208161—).

From 6. international workshop on rare earth-cobalt permanent magnets and their applications; Baden, Austria (31 Aug 1982).

Utilization of rare earth cobalt magnets in servo motors has resulted in improved volumetric efficiency and reduced cost. This paper will describe servo motor performance and cost advantages attainable with high energy rare earth magnets when reviewed from analytical studies and test results. (Author).

7946 (RCO—6, pp 21-30) **Effective replacement of metallic magnets by rare-earth cobalt.** Howe, D.; Birch, T.S. (Univ. of Sheffield (United Kingdom)). 1982. NTIS (US Sales Only), PC A99/MF A01. (CONF-8208161—).

From 6. international workshop on rare earth-cobalt permanent magnets and their applications; Baden, Austria (31 Aug 1982).

To take full advantage of the improved properties of rare-earth cobalt, and for its cost-effective use, design procedures must be based on accurately determined magnetic fields as well as overall performance equations. The paper discusses the underlying design principles of electro-mechanical permanent magnet devices in general terms, and considers a particular problem, a turbo-generator system, for which the inter-relationship of the predominant design parameters is established to simplify the selection of technical factors, including the geometry and type of magnet material. (Author).

7947 (RCO—6, pp 31-50) **Proliferation of rare earth magnets in computer peripherals.** Rashidi, A.S. (Hitachi Magnetics Corporation, Edmore, MI (USA)). 1982. NTIS (US Sales Only), PC A99/MF A01. (CONF-8208161—).

From 6. international workshop on rare earth-cobalt permanent magnets and their applications; Baden, Austria (31 Aug 1982).

Rare earth cobalt permanent magnets have proliferated in a broad spectrum of applications in computer peripheral devices. This paper presents the technical reasons for such proliferation and examines as to how the future performance needs for such devices will impact the trends in rare earth cobalt material development. This paper most specifically describes the use of rare earth cobalt actuators (stepper motors, servo motors, linear voice coil and rotary voice coil actuators) in computer peripherals such as mass storages devices and numerous types of matrix line and daisy wheel printers. (Author).

7948 (RCO—6, pp 171-176) **Use of $SmCo_5$ magnet in prosthetic dentistry.** Szoke, A.; Korponai, A. (Semmelweis Orvostudomanyi Egyetem, Budapest (Hungary)). 1982. NTIS (US Sales Only), PC A99/MF A01. (CONF-8208161—).

From 6. international workshop on rare earth-cobalt permanent magnets and their applications; Baden, Austria (31 Aug 1982).

The authors provide a review on the history of magnet's clinical application and the laboratory experiments of $SmCo_5$ magnet as a dental material. They demonstrate clinical cases where $SmCo_5$ magnets were used to increase the denture retention. (Author).

7949 (RCO—6, pp 277-285) **Measurements and standards for determining the permanent magnet properties of rare earth cobalt magnets.** Clegg, A.G. (Sunderland Polytechnic (United Kingdom). Magnet Centre). 1982. NTIS (US Sales Only), PC A99/MF A01. (CONF-8208161—).

From 6. international workshop on rare earth-cobalt permanent magnets and their applications; Baden, Austria (31 Aug 1982).

The standard method of measurement of the demagnetization curve of rare earth cobalt magnets is outlined. This involves external magnetization, assembly in an electromagnet and plotting of the curve with an X-Y recorder to form a hysteresigraph. The precautions to be taken and the errors and uncertainties of measurements and of the alternative standards are considered. (Author).

7950 (RCO—6, pp 287-295) **Measurement methods and standards for commercial REPM.** Greppi, G.; Buzetti, G. (Pechiney Ugine Kuhlmann, Milan (Italy)). 1982. NTIS (US Sales Only), PC A99/MF A01. (CONF-8208161—).

From 6. international workshop on rare earth-cobalt permanent magnets and their applications; Baden, Austria (31 Aug 1982).

The level of diffusion reached by REPM creates more and more the problem of measuring their characteristics. The equipments normally used to check traditional magnets are not easily adaptable to the properties of REPM especially what concerns the magnetic fields necessary to reach saturation, their measurement and the density of flux connected with them. (Author).

7951 (RCO—6, pp 297-304) **Measurement methods and standards for commercial rare earth permanent magnets.** Steingroever, E. (Magnet-Physik Dr. Steingroever GmbH, Koeln (Germany, F.R.)). 1982. NTIS (US Sales Only), PC A99/MF A01. (CONF-8208161—).

From 6. international workshop on rare earth-cobalt permanent magnets and their applications; Baden, Austria (31 Aug 1982).

Measurement of the hysteresis curve of rare earth permanent magnets and materials; working point of single magnets; magnetic flux, potential and working point in magnetic systems composed of magnets and iron poles; magnetization and calibration of magnets and magnetic systems. Permanent magnets are most important for the function of many devices. Their magnetic properties can vary considerably with composition and production method. Therefore the exact measurement of their magnetic values is necessary, especially for the costly rare earth magnets. We consider the measurement of 1) specific properties of the material, as shown by the hysteresis curve, 2) magnetic values of single magnets, 3) magnetic values of magnet systems, composed of magnets and iron pole pieces, 4) Ni as standard material for the calibration of magnetic measuring devices. (Author).

7952 (RCO—6, pp 485-498) **European market and principal applications of rare earth-cobalt magnets.** Weinmann, D. (Ugimag Recoma AG, Lupfig (Switzerland)); Gallo, F. (Aimants Ugimag S.A., St. Pierre d'Allevard (France)). 1982. NTIS (US Sales Only), PC A99/MF A01. (CONF-8208161—).

From 6. international workshop on rare earth-cobalt permanent magnets and their applications; Baden, Austria (31 Aug 1982).

Over the last few years rare earth-cobalt magnets have become more important taking a significant share of the magnet market. The most important applications, principal markets in Europe and future trends are described. (Author).

7953 (RCO—6, pp 525-536) **Magnetic anisotropy in RE transition metal alloys.** Asti, G.; Deriu, A. (Parma Univ. (Italy). Physics Inst.). 1982. NTIS (US Sales Only), PC A99/MF A01. (CONF-8208161—).

From 6. international workshop on rare earth-cobalt permanent magnets and their applications; Baden, Austria (31 Aug 1982).

The present knowledge about the magnetic anisotropy of rare-earth transition metal alloys is outlined with special emphasis on the compounds of the type RT_5 and R_2T_{17}, because of their technological importance. Recent experimental and theoretical investigations have clarified the role of the transition metal and rare earth in determining the high magnetic anisotropy that characterizes these compounds. Accurate studies of a variety of pseudobinary compounds have made evident the single ion nature of the rare earth anisotropy. Some discrepancies still persist with theoretical predictions for compounds of light rare earth. The concept of canted sublattices represents a step forward in the understanding of the anisotropy properties of this important class of magnetic materials; it has been succesfully applied to a number of unexplained phenomena. (Author).

7954 (RCO—6, pp 537-548) **Anisotropy fields in several 2:17 systems.** Wallace, W.E.; Satyanarayana, M.V.; Hirosawa, S. (Pittsburgh Univ. (USA). Dept. of Chemistry); Fujii, H. (Hiroshima Univ. (Japan). Faculty of Sciences). 1982. NTIS (US Sales Only), PC A99/MF A01. (CONF-8208161—).

From 6. international workshop on rare earth-cobalt permanent magnets and their applications; Baden, Austria (31 Aug 1982).

Magnetic properties and structural features of $R_2Cosub(17-x)Tsub(x)$ systems have been studied for R = Ce, Pr, Sm, Er and Yb, and T equalling some or all of the following: Ti, V, Cr, Mn,

Fe, Cu, Zr and Hf. The structures and magnetic ordering temperatures indicate that T replaces Co in the lattice. The anisotropy field is increased when the ternaries are formed, Zr having the largest effect per atom substituted, which offers an explanation for the Zr benefication of 2:17 R-Co permanent magnets. Studies have also been made of Rsub(2-x)R'sub(x)Cosub(17-y)Tsub(y) systems, with R and R' a pair of rare earths and T = Fe and/or Mn. Hsub(A) can be increased by using a properly chosen R,R' pair and by partial replacement of Co with Fe and/or Mn. The two effects reinforce one another but are not quite additive. The results indicate that band structure effects as well as preferential substitution in the Co sublattices are important for determining anisotropy. (Author).

7955 (RCO—6, pp 549-554) **Magnetic anisotropy of Sm^{3+} near point defects in $SmCo_5$ and Sm_2Co_{17}.** Jin han-Min; Chen Hui-Nan; Tang Da-Shing; Han Jung-Fan; Shi Yen (Jilin Univ., Changchun (China)). 1982. NTIS (US Sales Only), PC A99/MF A01. (CONF-8208161—).

From 6. international workshop on rare earth-cobalt permanent magnets and their applications; Baden, Austria (31 Aug 1982).

The T dependence of magnetic anisotropy of Sm^{3+} in $SmCo_5$ and Sm_2Co_{17}, perfect and defected, are calculated. It turns out that in some defected cases, the magnetic easy direction of Sm^{3+} is more close to the c plane than to the c axis. (Author).

7956 (RCO—6, pp 555-565) **Nucleation and propagation of reversed domains in RE-Co-magnets.** Kronmueller, H. (Max-Planck-Institut fuer Metallforschung, Stuttgart (Germany, F.R.)). 1982. NTIS (US Sales Only), PC A99/MF A01. (CONF-8208161—).

From 6. international workshop on rare earth-cobalt permanent magnets and their applications; Baden, Austria (31 Aug 1982).

The coercive field of RE-Co-magnets in general is factor of 10-50 smaller than the theoretically achievable fields of 30000-40000 kA/m in 'single phase' Co_5Sm sinter magnets. This discrepancy is shown to be due to the nucleation of reversed domains in magnetically less harder precipitations. The nucleation fields and the pinning fields for inhomogeneous phase boundaries are calculated on the basis of micromagnetism. In the case of precipitation hardened 17:2 permanent magnets the pinning of domain walls at the 5:1 cellular walls of the rhombic microstructure is found to determine the coercive field. (Author).

7957 (RCO—6, pp 567-583) **Enhancement of coercivity by heat treatment of Sm(Co,Fe,Cu,Zr)sub(7.5) magnets.** Rothwarf, F. (U.S. Army European Research Office, London (United Kingdom)); Tawara, Y.; Ohashi, K. (Shin-Etsu Chemical Company, Takefu, Fukui (Japan)); Fidler, J.; Skalicky, P. (Technical Univ., Vienna (Austria). Inst. fuer Applied Physics); Groessinger, R.; Kirchmayr, H. (Technical University, Vienna (Austria). Inst. of Experimental Physics); Shigiang, Liu; Strnat, K.J. (Dayton Univ., Ohio (United States of America)). 1982. NTIS (US Sales Only), PC A99/MF A01. (CONF-8208161—).

From 6. international workshop on rare earth-cobalt permanent magnets and their applications; Baden, Austria (31 Aug 1982).

Preliminary results of a series of coordinated experiments done at several laboratories are reported. Sets of Sm(Cosub(0.725)Fesub(0.20)Cusub(0.055)Zrsub(0.02))sub(7.5) samples were sintered at 1215 C and subsequently aged in steps of 50 C at temperatures, Tsub(A), where 700 C =< Tsub(A) =< 900 C. A nearly parabolic variation of (BH)sub(max) with Tsub(A) was found at room temperature with a maximum of 28.8 MGOe for Tsub(A) = 800 C. Hysteresis loops were measured for the range 300 K <= T <= 900 K to obtain the temperature dependence of 4πIsub(s), Bsub(r)and sub(I)Hsub(C). The anisotropy field was measured directly by using a singular point detection technique. Electron microscope micrographs show changes in the shape and size of a rhomboid cellular microstructure with aging temperature. The cell boundaries consist of a 1:5 crystal structure and the cell interiors consist of at least two plate shaped 2:17 phases. The intrinsic coercive force shows a dependence on the length and angle of the rhomboid cellular structure. (Author).

7958 (RCO—6, pp 585-597) **Domain wall pinning in REPM.** Fidler, J.; Skalicky, P. (Technical Univ., Vienna (Austria). Inst. of Applied and Technical Physics). 1982. NTIS (US Sales Only), PC A99/MF A01. (CONF-8208161—).

From 6. international workshop on rare earth-cobalt permanent magnets and their applications; Baden, Austria (31 Aug 1982).

The interaction between the microstructure and the magnetic domains determines the coercivity of REPM. The crystal lattice defects and precipitates, which act as domain wall pinning centres, are examined in single-phase Co_5RE magnets and in precipitation hardened 17:2-magnets using electron microscopy. In single-phase 5:1-magnets the magnetization reversal occurs by nucleation and growth of reversed domains. Grain boundaries are found to act as strong pinning centres for domain walls. The coercivity mechanism of precipitation hardened 17:2-REPM is controlled by domain wall pinning at a continuous copper containing precipitation phase and is interpreted in terms of a micromagnetic theory for domain wall pinning. (Author).

7959 (RCO—6, pp 609-630) **Microstructure and magnetic domain structure of 2:17 precipitation-hardened rare-earth cobalt permanent magnets.** Hadjaipanayis, G.C. (Kollmorgen Corporation, Hartford (United States of America)). 1982. NTIS (US Sales Only), PC A99/MF A01. (CONF-8209186—).

From 3. international symposium on magnetic anisotropy and coercivity in rare earth-transition metal alloys; Baden, Austria (3 Sep 1982).

The microstructure of commercial 2:17 precipitation-hardened permanent magnets has been examined and correlated with the magnetic properties and magnetic domain structure. Transmission electron microscope studies in the lower coercivity (Hsub(c) approximately 6 kOe) materials reveal a fine 'cellular' microcstructure with 2:17 rhombohedral cells surrounded by 1:5 hexagonal boundaries. In the higher coercivity materials (Hsub(c) approximately 14 kOe) 1:3 phase 'lamellae' appear superimposed on the cellular structure. However in both cases Lorentz electron microscopy shows domain walls which follow the cell boundaries indicating that they are the possible domain wall pinning centers. The coercivity is found to increase with the cell size. (Author).

7960 (RCO—6, pp 631-642) **Sintered '$SmCo_5$' magnets-relations between coercivity and the anisotropy of major and minor phases.** Liu, S.; Strnat, K.J.; Mildrum, H.F. (Dayton Univ., Ohio (USA)). 1982. NTIS (US Sales Only), PC A99/MF A01. (CONF-8209186—).

From 3. international symposium on magnetic anisotropy and coercivity in rare earth-transition metal alloys; Baden, Austria (3 Sep 1982).

Hysteresis loops of sintered $SmCo_5$ magnets were measured between 77 and 1000 K. Anisotropy parameters were determined from easy- and hard-axis magnetization curves of such magnets and of a Sm_2Co_7 powder compact. The temperature dependence of sub(M)Hsub(c) is compared with that of the magnetization and anisotropy of $SmCo_5$ and Sm_2Co_7. It is concluded that domain-wall pinning within a grain-boundary layer of Sm_2Co_7 is the mechanism controlling the magnetic hardness. (Author).

7961 (RCO—6, pp 655-666) **Giant intrinsic magnetic hardness in mixed lanthanide-transition metal compound series.** Oesterreicher, H. (California Univ., San Diego, La Jolla (USA)). 1982. NTIS (US Sales Only), PC A99/MF A01. (CONF-8209186—).

From 3. international symposium on magnetic anisotropy and coercivity in rare earth-transition metal alloys; Baden, Austria (3 Sep 1982).

The unorthodox phenomenology of giant intrinsic magnetic hardness effects constitutes an extreme aspect of an amorphous magnetism in site disordered crystalline and amorphous materials of high crystal field anisotropy. However, this fundamental effect is also of technological potential (permanent magnets, information storage). It probes for magnetic parameters and the degree of their local variations (magnetic amorphicity in a broad sense). In this paper some general trends for this effect as well as recent experimental and theoretical developments are presented. In particular

the strong chemical influence of partial substitution in such materials as RCosub(5-x)Msub(x), R = lanthanide, M = Ni, Cu, Al, Si on the magnitude of coercive force Hsub(c) and its temperature dependence is discussed. The chemical regularity is related to the different extent of moment quenching on transition metal according to the different nature of the substituent atom. This is formulated both, on statistical models of local environment as well as, in a further step, via energy considerations concerning the pinning of special corrugations of domain walls near atomic dimensions. (Author).

7962 (RCO—6, pp 721-731) **Structure and magnetic properties of $Ho_2Cosub(17-x)Msub(x)$ compounds.** Chuang, Y.C.; Wu, C.H.; Li, T.C.; Chang, S.C.; Kao, L. (Academia Sinica, Shengyang (China). Inst. of Metal Research). 1982. NTIS (US Sales Only), PC A99/MF A01. (CONF-8209186—).

From 3. international symposium on magnetic anisotropy and coercivity in rare earth-transition metal alloys; Baden, Austria (3 Sep 1982).

The homogeneous range of the pseudo-binary system $Ho_2Cosub(17-x)Msub(x)$ (M=Ni, Fe, Mn, Cr, Ti, V, Al, Cu) and the composition dependence of lattice constants, Curie temperature and room temperature coercive force were studied. Although Ho_2Co_{17}, Ho_2Ni_{17} and Ho_2Fe_{17} have identical crystal structure and close lattice constants, it was found that the homogeneous range for the Th_2Ni_{17} type compound in $Ho_2Cosub(17-x)Nisub(x)$, $Ho_2Cosub(17-x)Fesub(x)$ and $Ho_2Cosub(17-x)Cusub(x)$ respectively. This suggests that at low concentrations the effect of Ni, Fe and Cu on the Co-Co exchange interaction of the Co-sublattice may be different from that at high concentrations. (Author).

7963 (RCO—6, pp 733-742) **Magnetocrystalline anisotropy of $Pr_2(Cosub(1-x)Mnsub(x))_{17}$ compounds.** Jurczyk, M.; Wrzeciono, A. (Polish Academy of Sciences, Poznan (Poland). Inst. of Molecular Physics). 1982. NTIS (US Sales Only), PC A99/MF A01. (CONF-8209186—).

From 3. international symposium on magnetic anisotropy and coercivity in rare earth-transition metal alloys; Baden, Austria (3 Sep 1982).

Magnetic properties of rhombohedral $Pr_2(Cosub(1-x)Mnsub(x))_{17}$ intermetallics compounds with $0.0 <= x <= 0.25$ have been studied over a temperature range from 78 K to 1200 K in external fields up to 2.07 MA/m. Saturation magnetization and Curie temperature decrease monotonically with increasing x. The directions of easy magnetization were determined by x-ray studies on oriented powders. $Prsub2Co_{17}$ has an easy plane. Replacement of cobalt by manganese changes the easy magnetization direction from basal plane to c axis at x=0.15. The magnetic anisotropoy constants K_1 and K_2 was determined by at least square fit of the theoretical equation of magnetization to the measured magnetization curve along the hard axis. The anisotropy constant K_1 at 295 K for $Pr_2(Cosub(0.95)Mnsub(0.05))_{17}$, $Pr_2(Cosub(0.90)Mnsub(0.10))_{17}$, $Pr_2(Cosub(0.85)Mnsub(0.15))_{17}$ and $Pr_2(Cosub(0.80)Mnsub(0.20))_{17}$ and $Pr_2(Cosub(0.75)Mnsub(0.25))_{17}$ are. (Author).

7964 (RCO—6, pp 743-755) **Domain structure of compounds of heavy rare earths with cobalt and compounds $R_2Fe_3Co_{14}$.** Koczorowska, L.; Wrzeciono, A. (Polish Academy of Sciences, Poznan (Poland). Inst. of Molecular Physics). 1982. NTIS (US Sales Only), PC A99/MF A01. (CONF-8209186—).

From 3. international symposium on magnetic anisotropy and coercivity in rare earth-transition metal alloys; Baden, Austria (3 Sep 1982).

We have studied by the powder method, the magneto-optimal Kerr effect method and the wall grooving method the domain structure of the following intermetallic compounds of heavy rare earths with cobalt: RCo_5 (R = Gd, Tb, Ho, Er), R_2Co_7 (R = Gd, Tb, Dy, Ho), RCo_5 (GdCo5, TbCosub(5,1), HoCosub(5,5),$ErCo_5$), R_2Co_{17} (R = Gd, Tb, Dy, Ho, Er, Tm) as well as that of the compounds: $R_2Fe_3Co_{14}$ (R = Tb, Hō, Er, Tm). We have evaluated by the method of Bodenberger and Hubert the domain wall energy in the compounds: $GdCo_5$ - 5 mJ/m², HoCo5 - 1 mJ/m², $ErCo_5$ -1 mJ/m², Gd_2Co_7 - 45 mJ/m², Tb_2Co_7 - 8 mJ/m², GdCo5 -48 mJ/m², HoCosub(5.5) - 15 mJ/m², $ErCo_5$ - 43 mJ/m² and $Er_2Fe_3Co_{14}$ - 78 mJ/m². We have determined the dependence and the distance D between the centres of two nearest worm domains on the thickness L of the crystal, obtaining for $Ho_2Fe_3Co_{14}$ - D = 0.13 Lsup(0.65), Tm_2Co_{17} - D = 0.47 Lsup(0.63) $Tm_2Fe_3Co_{14}$ - D = 0.47 Lsup(0.62). Similarities in the surface domain structure occur for compounds having the same crystallographical structure and close lying values of the saturation magnetization and of the magneto-crystalline anisotropy. (Author).

7965 (RCO—6, pp 757-768) **NMR and anisotropy in $Y_2(Cosub(1-x)Mnsub(x))_{17}$ and $Gd_2(Cosub(1-x)Mnsub(x))_{17}$ compounds.** Figiel, H.; Kakol, Z. (Univ. of Mining and Metallurgy, Cracow (Poland)). 1982. NTIS (US Sales Only), PC A99/MF A01. (CONF-8209186—).

From 3. international symposium on magnetic anisotropy and coercivity in rare earth-transition metal alloys; Baden, Austria (3 Sep 1982).

The spin echo ^{59}Co NMR spectra and the anisotropy constants were measured versus Mn concentration. The Co atoms contributions to the magnetic anisotropy were calculated and resultant anisotropy appeared to be in agreement with the experimental results. The correspondence between local Co anisotropy contributions and the resonance spectrum is shown and discussed. (Author).

7966 (RCO—6, pp 771-783) **Magnetocrystalline anisotropy of rare-earth RCo_5 compounds.** Ermolenko, A.S. (Academy of Science of the USSR, Sverdlovsk (USSR). Inst. of Metal Physics). 1982. NTIS (US Sales Only), PC A99/MF A01. (CONF-8209186—).

From 3. international symposium on magnetic anisotropy and coercivity in rare earth-transition metal alloys; Baden, Austria (3 Sep 1982).

Present understanding of magnetocrystalline anisotropy of rare earth-cobalt compounds of RCo_5-type is reviewed. The magnetocrystalline anisotropy of rare-earth and cobalt sublattices are discussed in terms of crystal field theory. The main attention is paid to determination of single-ion anisotropy parameters of rare-earth ions in Rsub(x)Ysub(1-x) pseudobinary compounds. (Author).

7967 (RCO—6, pp 213-225) **High quality magnetic lock system for very grand masterkey systems.** Kirchmayr, H.R.; Groessinger, R. (Technical Univ., Vienna (Austria)). 1982. NTIS (US Sales Only), PC A99/MF A01. (CONF-8208161—).

From 6. international workshop on rare earth-cobalt permanent magnets and their applications; Baden, Austria (31 Aug 1982).

This new lock system of the European standard size for cylinders uses a key with up to 4 cylindrical magnets consisting of plastic bonded isotropic $SmCo_5$. Each surface of these magnets can be magnetized independently in one of 8 distinctively different directions. Therefore, $8^8 = 16.10^6$ differnet keys are possible. Corresponding to each magnetic surface in the key there are altogether 8 rotating $SmCo_5$ magnets in the lock. These 'rotors', bearing a groove, orient themselves according to the key. Only if full correspondence is achieved the lock can be operated. The magnetic code system is combined with a mechanical code system which allows an extremely high number of variations. The advantages of this new lock system which has been developed and produced in two different forms by the lock company EVVA (EVVA Werke, Wienerbergstr. 59-65, A-1121 Vienna (Austria)) and Zeiss Ikon (Zeiss Ikon AG, Goerzallee 299, D-1000 Berlin 37, Berlin-Zehlendorf (Germany, D.R.)) are discussed in detail. (Author).

7968 (UCRL—53458) **Investigation of the properties of a silver-aided solid-state bond between uranium and stainless steel.** Rosen, R.S. (Lawrence Livermore National Lab., CA (USA)). Dec 1983. Contract W-7405-ENG-48. 112p. NTIS, PC A06/MF A01. Order Number DE84004599.

Thesis.

Uranium has been joined to stainles steel by coating both faying surfaces with silver, followed by autoclave solid-state bonding of the silver interfaces. Rupture time varies with stress as t/sub r/ α σ^{-24}, for stresses ranging from 35 to 50 ksi at 22°C. Over the temperature range from -4 to 72°C, the apparent creep activation energy was 20.5 kcal/mol. The final stages of creep fracture consisted of the growth and coalescence of cavities at either the coated or bonded interfaces, followed by ductile tearing of the remaining

ligaments of silver. Cavity nucleation by creep deformation was the rate-controlling mechanism for stress rupture. Analysis of other possible creep mechanisms showed that diffusional creep would become rate controlling at low stresses, and the estimated creep lifetime would be several orders of magnitude less than extrapolated values from high-stress data. The average ultimate strength of the silver-bonded joints was 64 ksi, which exceeds the yield stress of both base metals.

7969 **(UCRL—89994) Energy-beam processing studies on Ta/U and Ir/Ta systems.** Kaufmann, E.N.; Peercy, P.S.; Jacobson, D.C.; Draper, C.W.; Huegel, F.J.; Echer, C.J.; Makowiecki, D.M.; Balser, J.D. (Lawrence Livermore National Lab., CA (USA); Sandia National Labs., Albuquerque, NM (USA); Bell Labs., Murray Hill, NJ (USA); Western Electric Co., Inc., Princeton, NJ (USA). Engineering Research Center). 11 Nov 1983. Contract W-7405-ENG-48. 9p. (CONF-831174—48). NTIS, PC A02/MF A01. Order Number DE84004885.

From Materials Research Society annual meeting; Boston, MA, USA (14 Nov 1983).

Films of Ta metal on uranium and of Ir metal on tantalum have been irradiated and melted by pulses from Q-switched Ruby and frequency-doubled Nd:YAG lasers to investigate the nature of the resulting mixtures in light of the very different binary-phase diagrams of the two systems. In addition, a two-phase Ir-Ta alloy has been surface-processed with CW CO_2-laser radiation and with an electron beam in order to study microstructure refinement and test the advantage of using alloys as opposed to film-on-substrate combinations for the development of claddings.

7970 **Effect of heavy dose implantations of B and C on the crystal structure and superconducting transition temperature of A-15 Nb_3Al.** Clapp, M.T. (Department of Mechanical Engineering, University of Massachusetts, Amherst, Massachusetts 01003). *Journal of Applied Physics;* **55**: No. 2, 331-337(15 Jan 1984). Contract AC02-80ER10566.

The effect of ion implantation on metastable phase formation and superconducting transition temperature (T/sub c/) has been investigated. The particular alloys studied were Nb_3Al/sub 1-x/B/sub x/ and Nb_3Al/sub 1-x/C/sub x/. A-15 Nb_3Al was used as the substrate material. Large doses of B and C (up to 23 at.%) were implanted into Al depleted surfaces. A series of implantation energies and doses was chosen to maintain the (Al+B) and (Al+C) concentrations equal to 25 at. %. This is necessary for achieving high T/sub c/ materials. Auger analysis indicated that there was very good agreement between experimental and theoretical dopant profiles immediately after implantation. After annealing up to 900 °C the B atoms showed very little redistribution; however the C atoms tended to migrate towards the surface. Structural analysis using a READ camera and a diffractometer indicated that the large doses of B and C had been implanted into the A-15 structure without affecting its stability; this A-15 phase remained stable up to 950 °C. Implantation caused the lattice parameter of the A-15 phase to increase by 1%—2%. There was no increase in the superconducting transition temperature above that of the substrate (18 K). This work is consistent with other studies; implantation has successfully produced metastable phases; however implantation into A-15's has not increased their T/sub c/'s.

7971 **Improved high field performance of Nb-Al powder metallurgy processed superconducting wires.** Thieme, C.L.H.; Pourrahimi, S.; Schwartz, B.B.; Foner, S. (Francis Bitter National Magnet Laboratory, Massachusetts, Institute of Technology, Cambridge, Massachusetts 02139). *Applied Physics Letters;* **44**: No. 2, 260-262(15 Jan 1984).

Improved overall critical current densities J/sub c/'s were achieved with powder metallurgy processed Nb-Al which combined reduced powder sizes and increased nominal areal reductions R. Increased J/sub c/ values were obtained for a variety of different heat treatments. For a Nb-8 wt. % Al wire with $R = 3.4 \times 10^5$ a very short treatment at 1100 °C followed by a 750 °C treatment gave (at 4.2 K)J/sub c/ $> 10^4$ A/cm² at 19 T; a 900 °C treatment followed by a 750 °C treatment gave J/sub c/ $= 10^4$ A/cm² at 18 T and, at 2 K, J/sub c/ was greater than 10^4 A/cm² at 20 T; and a treatment of 800 °C for 8 h gave (at 4.2 K)J/sub c/ $= 10^4$ A/cm² at 17.5 T.

7972 **Energy deposition and microstructural modification in dynamically consolidated metal powders.** Gourdin, W.H. (University of California, Lawrence Livermore National Laboratory, Livermore, California 94550). *Journal of Applied Physics;* **55**: No. 1, 172-181(1 Jan 1984). Contract W-7405-ENG-48.

A model is presented for the deposition of energy at powder particle surfaces during dynamic consolidation. The average energy flux incident on the surface of a powder particle is estimated to be E/tauA where E is the specific energy deposited by the shock, tau is the shock rise time, and A the measured powder specific surface area. This flux is assumed to be constant over the rise time of the shock, falling abruptly to zero for times longer than tau. Solution of the thermal transport equation subject to this boundary condition yields the thermal history within a powder particle having the area-equivalent diameter $D = 6/rho_0 A$, where rho_0 is the solid density. The magnitude of the temperatures and the heating and cooling rates indicate likely material transformations. The penetration of a given isotherm provides an estimate of the volume fraction of material transformed. Good agreement is found between model calculations and measurements of the extent of local martensite formation in consolidated 4330V steel powder and of local melting in consolidated aluminum-6% silicon and copper powders. The general implications of the model are discussed.

7973 **Scaling relations in the equation of state, thermal expansion, and melting of metals.** Guinea, F.; Rose, J.H.; Smith, J.R.; Ferrante, J. (Institute for Theoretical Physics, University of California at Santa Barbara, Santa Barbara, California 93106). *Applied Physics Letters;* **44**: No. 1, 53-55(1 Jan 1984).

A simple and yet quite accurate prediction of volume as a function of pressure for metals and alloys is presented. Thermal expansion coefficients and melting temperatures are predicted by simple, analytic expressions and results compare favorably with experiment for a broad range of metals. All of these predictions are made possible by the discovery of universality in binding energy relations for metals.

7974 **Experimental compressions for sodium, potassium, and rubidium metals to 20 kbar from 4.2 to 300 K.** Anderson, M.S.; Swenson, C.A. (Ames Laboratory U.S. Department of Energy and Department of Physics, Iowa State University, Ames, Iowa 50011). *Physical Review [Section] B: Condensed Matter;* **28**: No. 10, 5395-5418(15 Nov 1983). Contract W-7405-ENG-82.

Experimental piston-displacement equations of state are given for sodium, potassium, and rubidium to 20 kbar for temperatures from 4 K to just below the melting line in each case. Except for sodium at high pressures, where the low-temperature bcc-hcp martensitic transition appears to cause problems, these data can be represented by a room-temperature pressure-volume reference function and a thermal pressure which is a function of temperature only. In addition, these three solids appear to obey a reduced equation of state at both 4 K and room temperature, for which V/V_0 is a common function of P/B_0. A modification of the second-order Murnaghan equation which is well behaved at large compressions is used to extrapolate these results to 40 kbar for comparison with higher-pressure, room-temperature results. These data are compared with other high-pressure equation-of-state experiments and are extrapolated to $P = 0$ to obtain thermal expansions and isothermal bulk moduli, which in turn are compared with results from other measurements. These comparisons and those with theoretical calculations show, on the whole, satisfactory agreement. The elementary form for the temperature-dependent equation of state is in agreement with a previous suggestion that the Grueneisen parameter is temperature independent and is a linear function of the volume for temperatures greater than the Debye temperature. The 295-K Grueneisen parameters for these solids, as deduced from the high-pressure results, are 1.24 for sodium and potassium and 1.26 for rubidium.

7975 **Augmented Gaussian-orbital basis for atomic-cluster calculations within the density-functional formalism: Application to Cu_2.** Painter, G.S.; Averill, F.W. (Metals and Ceramics Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831). *Physical Review [Section] B: Condensed Matter;* **28**: No. 10, 5536-5548(15 Nov 1983).

The principle of augmentation, used to introduce inner-atom core structure into slowly varying basis functions, is applied to Gaussian orbitals to define a new basis set for highly accurate total-energy calculations for atomic clusters within the density-functional formalism. Diffuse Gaussian-orbital tails are matched continuously and differentiably to inner-atom numeric radial functions at the atomic-sphere radius. Major advantages of Gaussian-orbital basis sets are acquired without the need for numerous Gaussians of large exponent for the core region. The numeric functions used inside the atom permit essentially exact solutions for that region. Procedures are described which recover use of the efficient integral algorithms for the Gaussian-orbital-tail matrix elements. The interactions over the structured inner-atom region are treated by efficient integrand smoothing and integration procedures for the sphere. The new augmented Gaussian basis removes the primary limitations on the use of Gaussian orbitals for heavy atoms. As an illustration the method is applied to the copper dimer in an all-electron framework within the local-spin-density approximation (LSDA). The calculated binding energy, equilibrium separation, and first ionization potential of Cu_2 are within 2% of experiment within the Xα model. Excitation energies are better described within more recent refined exchange-correlation functionals. These all-electron results show the LSDA model predicts a slightly contracted bond length for Cu_2, consistent with bulk LSDA calculations for the 3d transition-metal series.

7976 **Temperature and field dependence of the magnetic susceptibility of $TiBe_2$ under high pressure.** Gerhardt, W.; Schilling, J.S.; Olijnyk, H.; Smith, J.L. (Experimentalphysik IV, Universitat Bochum, D-4630 Bochum 1, West Germany). *Physical Review [Section] B: Condensed Matter;* **28**: No. 10, 5814-5821(15 Nov 1983). Contract W-7405-ENG-82.

The magnetic susceptibility chi(T,P) of $TiBe_2$ is determined at a field strength of 2.1 T as a function of both temperature from 3 to 300 K and hydrostatic pressure up to 1.3 GPa (13 kbar). At low temperatures, chi is found to decrease under pressure, the degree of depression diminishing rapidly with increasing temperature from partialInchi/partialP = (-9.6 +- 0.4)%/GPa at 3 K to (0 +- 0.3)%/GPa at 300 K. Pressure is also found to suppress strongly the low-temperature anomaly in the field dependence of chi(H) at 5.6 T. An increase in the spin-fluctuation temperature with pressure is indicated, partialT/sub SF//partialP≅+3.5 K/GPa, where T/sub SF/(0)≅24 K, although it is not possible to account for the present results in terms of the variation of a single characteristic energy. The Stoner factor appears to decrease rapidly under pressure. The pressure dependence of the lattice parameter for $TiBe_2$ at room temperature is determined up to 27 GPa, yielding the initial compressibility $K = (7.6 +- 0.4) \times 10^{-3}$ GPa^{-1}. It is shown that the ferromagnetism of TiBe/sub 2-x/Cu/sub x/ for x> or =0.15 cannot be due solely to the volume expansion associated with increasing x. Preliminary measurements indicate that substituting Mn for Ti in $TiBe_2$ causes a strong decrease in the total magnetization in analogy with previous studies involving Fe substitution. A simple qualitative model of the electronic structure of $TiBe_2$ near E/sub F/ is suggested. $TiBe_2$ is not superconducting at temperatures above 150 μK.

7977 **Lattice dynamics of the A15 compound Nb_3Sb.** Pintschovius, L.; Smith, H.G.; Wakabayashi, N.; Reichardt, W.; Weber, W.; Webb, G.W.; Fisk, Z. (Solid State Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). *Physical Review [Section] B: Condensed Matter;* **28**: No. 10, 5866-5876(15 Nov 1983).

The phonon dispersion curves of Nb_3Sb have been studied by inelastic neutron scattering. All the branches have been determined in the main symmetry directions and the results are analyzed with Born—von Karman models of different complexity. A model with general forces up to the eighth-nearest neighbors gives excellent agreement with experiment. However, a rather good description of the dispersion curves is obtained with a model including axially symmetric forces up to the third-nearest neighbors, which indicates that these interactions are dominant. Temperature effects were found to be very small. Additional experiments were performed on polycrystalline samples to determine directly the phonon density of states. Our results obtained on Nb_3Sb are compared with the available phonon data on Nb_3Sn.

7978 **Hydrogen on Ta(110): Photoemission study using synchrotron radiation.** Murgai, V.; Weng, S.; Strongin, M.; Ruckman, M.W. (Physics Department, Brookhaven National Laboratory, Upton, New York 11973). *Physical Review [Section] B: Condensed Matter;* **28**: No. 10, 6116-6118(15 Nov 1983).

The adsorption of H and Ta(110) is studied by photoemission with the use of synchrotron radiation. The energy positions of the H-induced states observed at normal exit, at -2.2 and -6.5 eV, do not disperse with photon energy which is consistent with a two-dimensional layer of adsorbed H in contrast with previous reports. An otherwise prohibited bulk excitation is found to occur when hydrogen is adsorbed. These results are discussed and compared with bulk hydrogen-uptake data.

7979 **Ag/Cu(001): Observation of the development of the electronic structure in metal overlayers from two to three dimensionality.** Tobin, J.G.; Robey, S.W.; Klebanoff, L.E.; Shirley, D.A. (Materials and Molecular Research Division, Lawrence Berkeley Laboratory, Berkeley, California 94720 and Departments of Chemistry and Physics, University of California, Berkeley, California 94720). *Physical Review [Section] B: Condensed Matter;* **28**: No. 10, 6169-6171(15 Nov 1983).

Angle-resolved photoemission was used to investigate the valence-band structure of the metal overlayer system c(10 x 2)Ag/Cu(001). At 1—2 monolayer coverages, the Ag adlayer exhibited d-band spectral behavior characteristic of two-dimensional dispersion. Evaporation of progressively more Ag onto the substrate produced a series of surfaces which by 3—5 monolayer exposures were converging toward a three-dimensional valence electronic structure characteristic of a bulk, Ag(111)-like system.

7980 **Microstructural modification of austenitic stainless steels by rapid solidification.** Vitek, J.M.; Dasgupta, A.; David, S.A. (Oak Ridge National Laboratory, Oak Ridge, TN 37830). *Metallurgical Transactions, [Section] A: Physical Metallurgy and Materials Science;* **14A**: No. 9, 1833-1842(Sep 1983). Contract W-7405-ENG-26.

The microstructural modifications in three austenitic stainless steels (types 308, 310, and 312) were evaluated after rapid solidification. These three steels are commonly used weld filler metals. Two methods of rapid solidification were investigated, autogenous laser welding and arc-hammer splat quenching. The structure of 310 stainless steel was found to be 100% austenite, and did not vary over the range of conditions studied. On the contrary, the structures of types 308 and 312 steels were very sensitive to the cooling rates and solidification conditions. With the highest cooling rates, the type 308 structure was fully austenitic while the type 312 structure was fully ferritic. At lower cooling rates, the structures were duplex ferrite plus austenite. The results were interpreted in terms of faster kinetics of solidification of austenite compared to ferrite under the conditions examined. A comparison of the structures produced by the two rapid solidification techniques indicated the cooling rates are comparable.

7981 **Weld microstructure of $(Ni,Fe)_3$ (V,Ti) long-range-ordered alloy.** Braski, D.N.; David, S.A. (Oak Ridge National Laboratory, P.O. Box X, Oak Ridge, TN 37830). *Metallurgical Transactions, [Section] A: Physical Metallurgy and Materials Science;* **14A**: No. 9, 1785-1792(Sep 1983). Contract W-7405-ENG-26.

The microstructure of gas tungsten arc welds of a $(Ni,Fe)_3$ (V,Ti) long-range-ordered alloy has been investigated. Crack-free welds were produced in which the heat affected zone and fusion zone were disordered and softened. A post-weld heat treatment increased the hardness of both zones by reordering the structure. The reordering treatment produced additional hardening in the fusion

zone due to precipitation of small VC particles on grain boundaries and matrix dislocations.

7982 **The diffusivity of hydrogen in Nb stabilized stainless steel.** Outlaw, R.A.; Peterson, D.T. (NASA, Langley Research Center, Hampton, VA 23665). *Metallurgical Transactions,* [*Section*] *A: Physical Metallurgy and Materials Science;* **14A**: No. 9, 1869-1874(Sep 1983). Contract W-7405-ENG-82.

The evolution of hydrogen from 347 stainless steel has been studied by using a real time dynamic technique under ultrahigh vacuum conditions. Auger electron spectroscopy was used to determine the surface composition as a function of time and temperature. The surface film on the electropolished samples was found to be approximately 15 A thick and consisted of a carbon-oxygen complex and a metal oxide (Fe /SUB x/ O /SUB y/). Upon heating to 400 °C, the carbon-oxygen complex desorbed as CO and the remaining oxygen and carbon began to incorporate. Also at this temperature sulfur began to diffuse out of the bulk to the surface and at approximately 800 °C formed a complete monolayer. At 900 °C, carbon and oxygen virtually disappeared, leaving the monolayer of sulfur as the only surface contaminant. The hydrogen diffusivity was found to follow closely the equation $D = 7.01 \times 10^{-7} \exp(-48.0/R/TAU/)$ m^2 per second over the entire temperature range studied, thus indicating that hydrogen evolution is not significantly affected by the changing surface composition. The somewhat higher value of the diffusivity obtained in this work compared to past measurements in austenitic stainless steels may indicate the importance of sample preprocessing and ultrahigh vacuum conditions in minimizing the effects of surface layers.

7983 **An analysis of concentration profiles for fluxes, diffusion depths, and zero-flux planes in multicomponent diffusion.** Dayananda, M.A. (Purdue University, West Lafayette, IN 47907). *Metallurgical Transactions,* [*Section*] *A: Physical Metallurgy and Materials Science;* **14A**: No. 9, 1851-1858(Sep 1983). Contract AC02-81ER10814.

Concentration profiles developed during isothermal, multicomponent diffusion for a single-phase, solid-solid diffusion couple are expressed on the basis of a relative concentration variable for each component and analyzed for the determination of interdiffusion fluxes. The individual concentration profiles intersect at a common cross-over composition where the relative concentrations of all components are identical. New relations are developed for describing internal consistency among the concentration profiles of the various components. A link is made between the cross-over composition and the depths of the diffusion zone on either side of the Matano plane for a diffusion couple. The cross-over composition is interpreted as the average relative concentration of each component over the diffusion zone. The identification of a zero-flux plane from concentration profiles is also described. The analysis offers several advantages in presenting as well as checking the self-consistency of results as illustrated with a single phase Cu-Ni-Zn diffusion couple annealed at 775 °C.

7984 **A study of a cellular phase transformation in the ternary Ni-Al-Mo alloy system.** Kaufman, M.J.; Eades, J.A.; Fraser, H.L.; Loretto, M.H. (Department of Metallurgy and the Materials Research Laboratory at the University of Illinois, 1304 West Green Street, Urbana, IL 61801). *Metallurgical Transactions,* [*Section*] *A: Physical Metallurgy and Materials Science;* **14A**: No. 8, 1561-1572(Aug 1983). Contract AC02-76ER01198.

Orthorhombic Ni_3Mo has been observed as a product of a cellular precipitation reaction occurring at grain boundaries in both Ni-12Al-15Mo and a ternary eutectic Ni-12.8Al-22.2Mo(compositions in at.%) when heat treated at intermediate temperatures (600 to 850°C). Convergent beam electron diffraction and energy dispersive X-ray spectroscopy techniques have been employed to characterize the structure and composition of this phase in these alloys. Since this phase is usually heavily faulted, the diffraction symmetries are reduced, causing ambiguities in analysis. Therefore, a binary (nominally) stoichiometric Ni_3Mo alloy was produced and heat treated in a manner designed to minimize faulting. Convergent beam patterns obtained from this material exhibited symmetries that identify it as having the mmm point group; further analysis of the diffraction patterns led to the conclusion that the space group is Pmmn. These patterns were then used to aid in the interpretation of those taken from the ternary alloys. Orthorhombic Ni_3Mo was also observed within the grains of the ternary eutectic alloy following prolonged aging treatments; the orientation relationship between the Ni_3Mo and the fcc matrix was determined to be identical with that in the cellularly transformed regions.

7985 **Simple structural unit model for core-dependent properties of symmetrical tilt boundaries.** Balluffi, R.W.; Brokman, A. (Department of Materials Science and Engineering, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). *Scripta Metallurgica;* **17**: No. 8, 1027-1030(Aug 1983). Contract AC02-78ER05002.

Consider any physical property, p, of a grain boundary, which depends primarily on the atomic structure of the core, e.g., the boundary diffusivity or the core energy. This paper demonstrates that the recently determined structural unit model for the core structure allows one to estimate p for any boundary in a series of symmetrical tilt boundaries possessing a range of tilt angles if values of p for a few particular boundaries in the series are known. More specifically, we shall show that p for all boundaries with misorientations between those of two so-called "favored boundaries" can be estimated from a knowledge of the values of p for the two favored boundaries and the intermediate boundary made up of equal numbers of the structural units comprising the two favored boundaries. Applications of the results to measurements of boundary diffusivities and boundary energies are indicated briefly.

7986 **Hydrogen pressure dependence of the fracture mode transition in nickel.** Jones, R.H.; Baer, D.R.; Bruemmer, S.M.; Thomas, M.T. (Battelle-Northwest Laboratory, Richland, WA 99352). *Metallurgical Transactions,* [*Section*] *A: Physical Metallurgy and Materials Science;* **14A**: No. 8, 1729-1736(Aug 1983). Contract AC06-76RL01830.

A relationship between fracture mode, grain boundary composition, and hydrogen pressure has been determined for nickel straining electrode samples tested at cathodic potentials. This relationship can be expressed as C /SUB S/ α P /SUP -n/ /SUB H2/ where C /SUB S/ is the critical grain boundary sulfur concentration corresponding to 50% transgranular and 50% intergranular fracture and P /SUB H2/ is the hydrogen pressure. The value of n was found to be between 0.34 and 0.9. This expression was derived by relating C /SUB S/ to the hydrogen overpotential with the Nernst equation. At a cathodic test potential of -0.3 V (SCE), C / SUB S/ was equal to 0.20 monolayers of sulfur and at higher cathodic potentials or higher hydrogen pressures, C /SUB S/ decreased such that at -0.72 V (SCE) C /SUB S/ was equal to 0.045 monolayers of sulfur. The inverse hydrogen pressure dependence observed with cathodic hydrogen is similar to that for the hydrogen permeation rate or a critical hydrogen concentration derived by Gerberich et al. for gaseous hydrogen. This similarity between gaseous and cathodic hydrogen suggests that grain boundary impurities contribute to the hydrogen embrittlement process without altering the embrittlement process although this result does not indicate whether decohesion or plasticity dependent processes are responsible for the combined sulfur-hydrogen effect on the intergranular fracture of nickel.

7987 **The effect of hydrogen on the initiation of shear localization in plain-carbon steels.** Lin, J.K.; Oriani, R.A. (Department of Chemical Engineering and Materials Science, University of Minnesota, Minneapolis, MN 55455). *Acta Metallurgica;* **31**: No. 7, 1071-1078(Jul 1983). Contract AC02-79ER10450.

The role of hydrogen on the onset of shear localization in various spheroidized carbon steels has been studied. Round-notched specimens were used for this work. Experiments indicate that at low and medium input fugacities, the onset of shear localization is impeded by hydrogen, but at very high input fugacities, hydrogen enhances the initiation of localized shear bands. However, the nature o shear bands produced at high input fugacities is different from that at low input fugacities in AISI 100 steels. Scanning electron microscopy demonstrated that hydrogen of low and medium fugacity does not affect microvoids at strains up to the critical

strain for shear localization. However, hydrogen of very large input fugacity causes growth of microvoids in undeformed specimens, and the initiation of microcracks in specimens deformed to the critical strain.

7988 **The solubility and diffusivity of hydrogen in well-annealed and deformed iron.** Kiuchi, K.; McLellan, R.B. (Department of Mechanical Engineering and Materials Science, William Marsh Rice University, Houston, TX 77251). *Acta Metallurgica;* 31: No. 7, 961-983(Jul 1983).

It has been shown that a large volume of data for the solubility of hydrogen in iron is affected by spurious surface conditions. Arrhenius plots of solubility data in the temperature range 300-1750 K, which are free of such effects, exhibit a temperature variation which, despite the low H-solubility in the entire temperature range, is not consistent with regular mixing statistics. This departure from regular behavior is consistent with the thermal activation of H atoms into energetically less favorable octahedral sites as the temperature is increased. The enhancement in H-solubility caused by the cold deformation of iron can be understood in terms of a simple Maxwell-Boltzmann distribution of H atoms between "normal" lattice sites and "trapping" sites of depth 34 kJ/mol. The 62 currently existing sets of data for the diffusivity of hydrogen through b.c.c. iron exhibit a large degree of mutual inconsistency. Exhaustive statistical analysis of this large data mass has shown that only those data obtained by electrochemical methods and H_2-gas equilibration methods using UHV techniques and Pd-coated membranes are reliable. The problem of H-diffusion in deformed iron has been analysed using a semi-quantitative model in which the retarding effect of trapping sites on the diffusivity is partially compensated by a "pipe" diffusion contribution along dislocations. It is shown that this model is in accord with the diffusivities measured in deformed iron when data not encumbered by spurious surface effects are considered.

7989 **Evidence for the growth mechanism of Cr_2O_3 at low oxygen potentials.** Hindam, H.; Whittle, D.P. (Lawrence Berkeley Laboratory, Univ. of California, Berkeley, CA). *Journal of the Electrochemical Society;* 130: No. 7, 1519-1523(Jul 1983). Contract AC03-76SF00098.

The growth rate of Cr_2O_3 on pure Cr, Ni-25, and 50% Cr and Co-25% Cr in flowing CO-CO_2 mixtures of effective oxygen pressures in the range 8.4×10^{-15}–8.3×10^{-9} atm at 1000°C has been measured. The parabolic growth constant is virtually independent of oxygen potential for both pure Cr and the alloys; for the alloys, it is about an order of magnitude smaller than for pure Cr. These results provide supportive evidence for Cr interstitials being the predominating mobile defect species in Cr_2O_3 under these conditions.

7990 **Diffusion-coupled active dissolution in the localized corrosion of stainless steels.** Newman, R.C.; Isaacs, H.S. (Brookhaven National Laboratory, Upton, NY). *Journal of the Electrochemical Society;* 130: No. 7, 1621-1624(Jul 1983).

The authors have examined the anodic dissolution of stainless steels in environments relevant to localized corrosion in neutral chloride solutions. There is a maximum active dissolution rate, for a given potential, which is not associated with the most concentrated localized environment. This observation seems to be significant with respect to the stability of localized corrosion in these alloys. Results of this kind are capable of explaining the existence of a critical pit solution, a protection potential against pitting, multiple steady states, low frequency electrochemical noise and differences between open circuit and potentiostatic behavior.

7991 **Rate-dependent plastic flow in polycrystalline silver at ambient temperature.** Kassner, M.E.; Mukherjee, A.K. (Lawrence Livermore National Laboratory, Livermore, CA 94550). *Scripta Metallurgica;* 17: No. 6, 741-744(Jun 1983). Contract W-7405-ENG-48.

This investigation is a continuation of work by Logan, Castro, and Mukherjee in which the mechanical properties of cold-worked (about 12 percent) polycrystalline silver at low temperature (77 to 473 K) were studied. Those authors interpreted their results as support for the intersection of dislocations as the controlling mechanism for plastic flow. That conclusion seems to have been based largely on the observation that the activation area, A, decreases with increasing strain, as would be theoretically expected. However, from strain-rate change tests performed over a strain range of 20 percent at 77 K, those investigators found a decrease of only a factor of two in A. In the present investigation, the proposition of the dislocation-intersection mechanism was analogously tested with annealed polycrystalline silver. If the dislocation intersection mechanism is appropriate, a more demonstrative decrease in A (e.g., over a factor of ten) would be expected in this case over the same strain range of 20 percent.

7992 **Cyclic grain boundary migration during high temperature fatigue--II: measurements of grain boundary sliding.** Langdon, T.G.; Gifkins, R.C.; Simpson, D. (Departments of Materials Science and Mechanical Engineering, University of Southern California, Los Angeles, CA). *Acta Metallurgica;* 31: No. 6, 939-946(Jun 1983).

Experiments were conducted to measure the extent of grain boundary sliding in high purity lead subjected to fatigue testing at room temperature. It is shown that the average sliding offset perpendicular to the surface, v, increases rapidly during the initial about 25 cycles of testing, increases at a reduced rate thereafter, and ultimately stabilizes after about 300 cycles. The value of v at any selected number of testing cycles decreases with decreasing strain amplitude at constant frequency but is independent of frequency at constant strain amplitude within the limited range of frequencies examined experimentally (0.17-0.50 Hz). The value of v also increases with an increase in grain size at constant frequency and strain amplitude. In fatigue tests conducted at zero mean strain, there is an essentially equal contribution from positive and negative sliding offsets, so that the net displacement is zero. Slide hardening is no important in fatigue at low cycles in the presence of extensive grain boundary migration. The average rates of sliding in fatigue are comparable to the average sliding rates in the very early stages of creep.

7993 **Cyclic grain boundary migration during high temperature fatigue--I: microstructural observations.** Langdon, T.G.; Gifkins, R.S. (Departments of Materials Science and Mechanical Engineering, University of Southern California, Los Angeles, CA). *Acta Metallurgica;* 31: No. 6, 927-938(Jun 1983).

Experiments were conducted on high purity lead at room temperature using reverse bending and torsion fatigue at low cyclic frequencies ($\leqq$1.50 Hz). Metallographic observations after testing show that there is a one-to-one correspondence between the markings from grain boundary migration and the number and pattern of cyclic loading, and this correspondence is maintained up to >100 cycles. Grain boundary sliding occurs in each cycle in addition to the migration, and this leads to the development of broad triple point folds. If the strain amplitude is maintained constant, it is shown that the average distance migrated in each cycle increases as the imposed frequency is decreased. The distance migrated is often exceptionally large in the first cycle of testing, and there is often a similar large initial displacement if the test is interrupted for periods of time from 1 to 24 h and then continued. For large grain sizes ($\geqq$ 2000μm), the migration markings may lead to a zig-zag pattern where the individual segments lie fairly close to 45° to the stress axis. A model is described which accounts for the one-to-one correspondence and which is consistent with a fine structure observed within the migration markings.

7994 **A study of intergranular cavity growth controlled by the coupling of diffusion and power law creep.** Wang, J.S.; Martinez, L.; Nix, W.D. (Department of Materials Science and Engineering, Stanford University, Stanford, CA 94305). *Acta Metallurgica;* 31: No. 6, 873-882(Jun 1983). Contract AT03-79ER10378.

A technique based on pre-creeping and sintering is used to create large, widely spaced cavities at grain boundaries in copper. The size and spacing of the cavities is such that cavity growth is expected to be controlled by the coupling of diffusion and power law creep. The rupture properties of these pre-cavitated samples are studied over a range of stresses and temperatures and the results are compared with the predictions of various theoretical treatments

of cavity growth. The stress and temperature dependence of rupture can be described using an analysis of the type suggested by Chen and Argon, provided that the diffusional length is based on the ligament stress rather than the applied stress.

7996 **Irradiation induced order-disorder in Ni_3Al and NiAl.** Liu, H.C.; Mitchell, T.E. (Department of Metallurgy and Materials Science, Case Western Reserve University, Cleveland, OH 44106). *Acta Metallurgica;* **31**: No. 6, 863-872(Jun 1983). Contract AC02-76ER02119.

Irradiation induced order-disorder phenomena in Γ-Ni_3Al and β-NiAl have been investigated by high voltage electron irradiation at temperatures from 10 to 470 K. In Ni_3Al, at T ≦ 190 irradiation creates a completely disordered structure by 1 dpa. At T ≃ 200-240 K, a residual state of order with S ≃ 0.1-0.15 is created by about 2 dpa, and disordering rates are found to be temperature dependent. Irradiation-enhanced re-ordering through an interstitialcy mechanism is a likely explanation in this temperature regime. At T ≧ 250 K, intermediate degrees of order with S ≧ 0.2 are produced by irradiation. The degree of order in Ni_3Al increases with increasing irradiation temperature and re-ordering through the migration of vacancies is apparently more effective than the migration of interstitials. NiAl, CoAl and NiGa still maintain partially-ordered states even after irradiation at 10 K (150 K for NiGa) to 3 dpa. By contrast, FeAl and CoFe irradiated at 150 K develop completely disordered states by 1.2 dpa. This is explained by the high ordering energies in NiAl, CoAl and NiGa, and the energetically favorable nature of "right" recombinations of radiation-induced interstitials and vacancies. The effect of crystallographic orientation on disordering rates suggests that "wrong" recombination of point defects is the more likely disordering mechanism at lower voltage irradiations and the replacement collision sequence mechanism becomes important at higher voltage irradiations.

7996 **Diffusive intergranular cavity growth in creep in tension and torsion.** Stanzl, S.E.; Argon, A.S.; Tschegg, E.K. (Massachusetts Institute of Technology, Cambridge, MA 02139). *Acta Metallurgica;* **31**: No. 6, 833-844(Jun 1983). Contract AC02-77ER04461.

Creep experiments were performed at 500 C in tension and torsion on high conductivity copper tubes with a uniform initial coverage of implanted water vapor bubbles on all grain boundaries. No significant differences were found in the times to fracture over a wide stress range when the results were correlated according to the maximum principal tensile stress in the two fields. The results indicate that the cavities grow in a crack-like mode but at one tenth the rate predicted from the theoretical model of Pharr and Nix. This difference is attributed partly to load shedding from boundaries normal to the maximum principal tensile stress to slanted boundaries, and partly to a lack of knowledge about th surface diffusion constant. The results indicate further that the contribution to intergranular cavity growth by power-law creep in negligible in comparison to the contribution by diffusional flow. Complementary tension and torsion experiments performed in initially uncavitated samples results in shorter creep lives in torsion than in tension due to more effective cavity nucleation in the former. The times to fracture in both of these cases obey Monkman and Grant's law, indicating the presence of constraints on growth by the lagging deformations by power-law creep in the surroundings of the cavitating isolated grain facets.

7997 **HVEM in situ deformation of Al-Li-X alloys.** Crooks, R.E.; Kenik, E.A.; Starke, E.A. Jr. (Fracture and Fatigue Research Laboratory, Georgia Institute of Technology, Atlanta, GA 30332). *Scripta Metallurgica;* **17**: No. 5, 643-648(May 1983). Contract W-7405-ENG-26.

Lithium additions to aluminum alloys increase both the strength and elastic modulus while decreasing the density, thereby resulting in very attractive combinations of properties. The commercial utilization of these alloys, however, has been hindered by a lack of adequate ductility at peak strength. Recent investigations have attributed the low ductility to intense, localized deformation. This is considered to be due to the promotion of planar slip by coherent, shearable, δ′ (Al_3Li) precipitates and the presence of precipitate free zones (PFZ's) at high angle grain boundaries. An Al-Cu-Li-Mg-Zr alloy, produced by rapidly solidified powder processing, was found to exhibit ductility improvements over comparable, lithium-containing alloys. Thin foils prepared from bulk tensile samples were examined by transmission electron microscopy (TEM), and no evidence of localized deformation was found. These, however, were only successfully produced from the region of uniform elongation below the neck and were thus limited to approximately 4% plastic strain. In order to observe the deformation behavior under severe strain, an in situ deformation study was conducted in a high voltage electron microscope (HVEM). Several investigators have used in situ HVEM techniques to study ductile fracture processes. The advantages of HVEM versus TEM for this purpose include: thicker specimens (due to a lower energy exchange of the electrons), a lower specimen contamination rate and a negligible increase in specimen temperature. Two lithium-containing alloys which had been previously reported to demonstrate localized, planar slip were studied for comparison.

7998 **The effects of minor alloy modifications and heat treatment on the microstructure and creep rupture behavior of 2.25Cr-1Mo Steel.** Todd, J.A.; Chung, D.W.; Parker, E.R. (Dept. of Materials Science, Univ. of Southern California, Los Angeles, CA). pp 179-193 of American Society of Mechanical Engineers pressure vessel and piping conference. New York, NY; A.S.M.E. (1983). (CONF-830607—).

From American Society of Mechanical Engineers pressure vessel and piping conference; Portland, OR, USA (19 Jun 1983).

The effects of alloy additions on the microstructure of simulated cooled and tempered 2.25Cr-1Mo steels have been studied using transmission electron microscopy. Carbide precipitation sequences have been identified in the modification 3Cr-1Mo-1Mn-1Ni and compared to those in 2.25Cr-1Mo steels modified with Mn and Ni and also with Ti, V and B. The influence of minor compositional changes on the creep rupture behavior of 2.25Cr-1Mo steel has been studied at 500 C, 560 C, and 600 C. The most significant effect of alloy modifications on creep properties resulted from additions of Mn and Cr. Preliminary studies show that 1% Mn and 0.5Mn + 1Ni + 0.75Cr additions significantly reduce creep strength at all three temperatures for tests up to 2000 hours duration. The 3Cr-1Mo-1Mn-1Ni steel showed improvements in rupture ductility at all temperatures when compared with the base 2.25Cr-1Mo steel and the manganese-nickel modifications. Plots of the Larson-Miller parameter for both these modifications lay within the scatter band for commercial 2.25Cr-1Mo steels.

7999 **Hydrogen attack of thick section pressure vessel steels.** Chung, D.W.; Parker, E.R.; Todd, J.A.; Youngs, J.K. (Dept. of Materials Science and Mineral Engineering, Univ. of California, Berkeley, CA). pp 25-52 of American Society of Mechanical Engineers pressure vessel and piping conference. New York, NY; A.S.M.E. (1982). (CONF-830607—).

From American Society of Mechanical Engineers pressure vessel and piping conference; Portland, OR, USA (19 Jun 1983).

The thick section pressure vessel steels, A387 2.25Cr-1Mo; A533B Mn-Mo-Ni steel and modifications containing MnNiCr and MnCrSi respectively, have been exposed to hydrogen atmospheres at 550 C, of 10 MPa or 13.8 MPa pressure, for periods of 500 hours and 1000 hours. At the lower pressure, the Mn-Mo-Ni steels, which contained predominantly M_3C carbides, showed macroscopic blisters and extensive grain boundary cavities in the as-received and 0.7Mn modified conditions, but revealed very little damage when modified with 1% chromium. No hydrogen attack damage was observed in the 2.25Cr-1Mo modifications at 10 MPa. At higher pressure, the Mn-Mo-Ni steels showed extensive hydrogen attack damage. The 2.25Cr-1Mo steels are considerably less damaged by hydrogen attack than are the Mn-Mo-Ni steel and its modifications. Mechanical properties for a series of alloy modifications are presented and related to the stability of the microstructure and the heat treatment conditions.

8000 **Dynamical behavior of the subsurface region in alloys under ion bombardment at high temperatures.** Lam, N.Q.; Wiedersich, H. (Argonne National Lab., IL). pp 35-42 of Metastable materials formation by ion implantation. Picraux, S.T.; Choyke, W.J. (eds.). Amsterdam, Netherlands; Elsevier Science Publishing Co., Inc. (1982).

Modifications of subsurface alloy composition by bombardment with ions of several keV energy were investigated theoretically, using a phenomenological model which includes the effects of various processes, such as preferential sputtering, displacement mixing, Gibbsian adsorption, radiation-enhanced diffusion, and radiation-induced segregation. The nonuniformity of damage rates, resulting from slow-down of the incoming ions, was also taken into account. The alloy composition evolution in time and space was calculated numerically for different temperatures, using concentrated Ni-Cu as a model alloy system. A good qualitative agreement between the present model calculations and recent experimental measurements was obtained.

8001 **High cycle fatigue.** Soo, P. (Brookhaven National Lab., Upton, NY). pp 499-506 of Pressure vessels and piping: design technology, 1982: a decade of progress. Zamrik, S.Y.; Dietrich, D. (eds.). New York, NY; American Society of Mechanical Engineers (1982).

Developments in high cycle fatigue technology over the last decade have been summarized. Uses of such data in the engineering field have been outlined together with the types of research which have been carried out to develop a better understanding of high cycle fatigue failure mechanisms. In addition, the relationships between low-cycle, high-cycle, and ultra high-cycle fatigue have been discussed.

8002 **Invariant line and loss of coherency in Mo(C) system.** Lang, J.M. (Lawrence Berkeley Lab., CA). pp 622-623 of 40th annual proceedings of the Electron Microscopy Society of America. Bailey, G.W. (ed.). Washington, DC; Electron Microscopy Society of America (1982). Contract W-7405-ENG-48.

This paper reports a detailed study of the loss of coherency of hcp Mo_2C precipitates in an bcc Mo matrix. The existence of an invariant line in the phase transformation is experimentally verified.

8003 **Accommodation of a change in grain boundary plane in molybdenum.** Kamenetzky, E.A. (Lawrence Berkeley Lab., CA). pp 624-625 of 40th annual proceedings of the Electron Microscopy Society of America. Bailey, G.W. (ed.). Washington, DC; Electron Microscopy Society of America (1982). Contract W-7405-ENG-48.

Contrast experiments were performed with both strong excitation conditions (two beam cases where either one or both grains are strongly diffracting) and weak excitation conditions (weak beam cases which induce more localized sampling of the strain fields of the GBD's). The main component is a twist of 4° around [101] which is the normal to the boundary plane. Within experimental error of +- .5°, there is no detectable tilt component. The dislocation Burgers vectors are of the type b = a/2 [111] and the dislocation line directions are [010], [101], and [111].

8004 **Habit plate shift and the morphology of α'' nitride precipitate in α-Fe.** Shih, Y.C.; Morris, J.W. Jr. (Lawrence Berkeley Lab., CA). pp 728-729 of 40th annual proceedings of the Electron Microscopy Society of America. Bailey, G.W. (ed.). Washington, DC; Electron Microscopy Society of America (1982). Contract AC03-76SF00098.

By theoretical calculation, the preferred habit plane of the α'' precipitate is (100) when $K<11.34$ and shifts toward (102) plane when $K>11.34$. In the present work, the habit plane shift phenomenon was observed in Fe-0.011%. The shifted angle from (100) increases as aspect ratio increases.

8005 **Measurement of degree of order in ordered alloys by convergent beam electron diffraction patterns.** Braski, D.N.; Bentley, J.; Cable, J.W. (Oak Ridge National Lab., TN). pp 692-693 of 40th annual proceedings of the Electron Microscopy Society of America. Bailey, G.W. (ed.). Washington, DC; Electron Microscopy Society of America (1982). Contract W-7405-ENG-26.

Long-range-ordered alloys, with $(Fe,Ni)_3V$ compositions, are being developed for possible use in fusion reactors and other elevated-temperature applications. It would be advantageous to monitor the long-range-order parameter in small samples of these alloys after irradiation, heat treatment, welding, etc. A convenient method which uses convergent beam electron diffraction for measuring S has been developed.

8006 **Structure determination of Ni_3Mo using convergent beam electron diffraction.** Kaufman, M.J.; Fraser, H.L. (Univ. of Illinois, Urbana). pp 686-687 of Proceedings of Electron Microscopy Society of America. Bailey, G.W. (ed.). Ithaca, NY; Electron Microscopy Society of America (1982). Contract AC02-76ER01198.

A [100] zone axis CBED pattern from the faulted structure shows this pattern exhibits little symmetry, certainly less than the 2mm expected. Another alloy, corresponding to Ni_3Mo, was prepared; the alloy was solution heat treated, quenched and subsequently aged at 900°C for 170 hours. The CBED shows an area of the aged material with two different diffracting vectors and the absence of faults should be noted. Zone axis CBED patterns from the aged material are presented and both low and high camera length information is included. The symmetry information is tabulated. The only possible point group consistent with this data is mmm.

8007 **The use of ion accelerators and synchrotron radiation to study the interactions of helium with metals.** Donnelly, S.E.; Gilles, J.M.; Lucas, A.A.; Rife, J.C. (Institute for Research in Interface Science (I.R.I.S.), FNDP-Namur). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 2, 1820-1823(Apr 1981). (CONF-801111—).

From 6. conference on application of accelerators in research and industry; Denton, TX, USA (3 Nov 1980).

A technique is described which examines the properties of helium trapped in bubbles in implanted metals. Helium implanted materials are characterized using resonant elastic proton backscattering and Transmission Electron Microscopy. Spectroscopic measurements using synchrotron radiation in the far vacuum ultraviolet are then performed to examine the density sensitive optical absorption resulting from the 1S - 2P transition in the implanted helium. Experimental data for helium implanted aluminum thin films are presented which indicate atomic densities in small (50A diameter) bubbles of the order of 10^{23} atoms cm^{-3}.

8008 **Analysis of laser alloyed surfaces.** Jacobson, D.C.; Augustyniak, W.M.; Buene, L.; Draper, C.W.; Poate, J.M. (Bell Laboratories, Murray Hill, New Jersey). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 2, 1828-1830(Apr 1981). (CONF-801111—).

From 6. conference on application of accelerators in research and industry; Denton, TX, USA (3 Nov 1980).

Surface alloys of precious metals have many advantages over bulk alloys, the most obvious of which is cost reduction due to the reduced consumption of precious metal. There are several techniques for producing surface alloys. In this paper the laser irradiation technique is presented. The following lasers: CW CO_2, Q-switched Nd-YAG, frequency double Q-switched Nd-YAG, and pulsed ruby were used to irradiate and melt thin solid films of precious metals on metal substrates. This causes the surfaces to melt to a depth of approximately 10,000A. Alloying then takes place in the liquid phase where most metals are miscible. The high quench rates obtainable by this method of melting can result in the forming of metastable alloys. This melting and regrowth process is well understood and has been discussed in the literature over the last few years. This paper deals with two binary alloy systems, Au-Ni and Pd-Ti. Surface alloys of Au-Ni with a wide range of concentrations have been produced by laser irradiation of thin Au films on Ni. These films have been analyzed using Rutherford backscattering (RBS) and channeling. Many thin film metals other than Au have also been successfully alloyed using these methods. An example of a potential application is the laser surface alloying of Pd to Ti for corrosion passivation.

8009 **Rutherford backscattering with heavy ions.** Sullins, R.T.; Leite, C.V.B.; Schweikert, E.A. (Texas A & M University, College Station, Texas). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 2, 1831-1833(Apr 1981). (CONF-801111—).

From 6. conference on application of accelerators in research and industry; Denton, TX, USA (3 Nov 1980).

The mass resolution capabilities of heavy ion Rutherford backscattering spectrometry (HIRBS) have been explored. A generalized prediction has been made of the maximum mass resolution that can be obtained in HIRBS. The experimental mass analysis capabilities of three heavy ion beams, 24 MeV ^{16}O, 23 MeV ^{20}Ne, and 38 MeV ^{40}Ar was investigated in detail. Using these beams, a mass difference of 1 amu can be determined at a target mass of 25 amu; a mass difference of 2 amu can be determined at a target mass of 65 amu. For each beam, the energy differences necessary for qualitative and quantitative analysis were determined. For the ^{16}O beam the corresponding experimental values are 250 and 350 keV, respectively, for qualitative and quantitative determination. For the ^{20}Ne beam the values are 275 and 425 keV, for the ^{40}Ar beam the values are 700 and 1200 keV. From these experimental ΔE values the mass resolution achievable with each beam is estimated. HIRBS is potentially capable of resolving neighboring masses for $50 < M < 100$ and appears well suited for detecting such species on the surface of low Z substrates.

8010 **Ion beam methods applied to interior ballistic studies.** Niler, A. (Ballistic Research Lab., ABRADCOM, Aberdeen Proving Ground, Maryland 21005). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-28: No. 2, 1834-1837(Apr 1981). (CONF-801111—).

From 6. conference on application of accelerators in research and industry; Denton, TX, USA (3 Nov 1980).

High temperature, pressure and velocity gases produced during the interior ballistic cycle of a gun firing are responsible for considerable damage to the steel surfaces of a gun bore. This damage is studied by exposing steel samples to the erosive flows of burning propellant gases in a modified 37mm gun chamber where pressures of 200 MPa and flame temperatures of 3000°K are typical. Ion beam methods are used to characterize the composition of the steel surfaces by combined nuclear reaction (NR) and elastic backscattering (EBS) analysis and thin layer activation (TLA) is used to measure surface wear rates. Combined fits to the EBS and NR distributions yield concentrations and depth profiles of carbon, nitrogen and oxygen as well as iron and other heavier elements. Hydrogen concentrations have also been measured on some of the samples. The results of these experiments show the presence of two different erosion mechanisms. In one, the surface is softened by thermo-chemical processes prior to removal by the shear forces of the gas flow while in the other surface layer melting occurs prior to removal. TLA using the $^{56}Fe(p,n)^{56}Co$ reaction has been used to measure wear from a 20 mm barrel and is being instrumented for larger barrels. EBS is being used to characterize the interfaces between steel substrates and coatings designed to reduce erosion.

8011 **The dependent accumulation of hydrogen on nickel foils.** La Marche, P.H.; Lanford, W.A.; Rauch, F. (Yale University, New Haven, Connecticut 06520). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-28: No. 2, 1845-1847(Apr 1981). (CONF-801111—). Contract AC02-76ER03074.

From 6. conference on application of accelerators in research and industry; Denton, TX, USA (3 Nov 1980).

As part of their investigation into the production of large area hydrogen free surfaces, the authors have studied the effectiveness of in vacuo (10^{-6} torr) high temperature (10^3 °C) heating of various materials suitable for use in ultra-cold neutron containers. Foils of the materials were resistively heated and subsequently measured for surface hydrogen concentration, using a nuclear resonant reaction technique, as a function of time. The authors were successful in cleaning the materials of hydrogen and several foils, for which they were able to heat to the point of evaporating their surface, remained relatively clean for several hours. For nickel, the authors found that this slow recontamination rate is independent of foil length and inversely proportional to thickness. They conclude that hydrogen incident upon the cleaned material can stick to the surface and then diffuse into the interior and is probably resident on the internal grain boundary surfaces.

8012 **The influence on hydrogen permeation through steel of surface oxide layers and their characterisation using nuclear reactions.** Earwaker, L.G.; Cheetham, J.L.; Farr, J.P.G.; Ross, D.K. (University of Birmingham). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-28: No. 2, 1848-1850(Apr 1981). (CONF-801111—).

From 6. conference on application of accelerators in research and industry; Denton, TX, USA (3 Nov 1980).

The rate of hydrogen permeation through metals is important in many technological applications, not least in the nuclear industry. Permeation measurements at elevated temperature, made under conditions likely to be found in industry, have shown that oxide layers which form on the surface of steels can sometimes reduce permeation drastically. Measurements have been made on a range of steels, including AISI 321, AISI 316L, Fecralloy and 9% Cr/1% Mo, at temperatures from 600°C up to 1100°C and the oxide layers produced have been investigated using a range of nuclear reactions. Oxygen content has been measured using the $^{16}O(d,p)$ reaction and, in the case of Fecralloy, the thickness of Al_2O_3 measured using the $^{27}Al(p,\gamma)$ reaction. Rutherford backscattering of alpha particles has also been used to investigate the behaviour of the surface layers, particularly for those alloys containing additives. Results show that at the lower temperatures investigated the oxide layers are generally mixed, while at higher temperatures they are largely Cr_2O_3, or Al_2O_3 in the case of Fecralloy. The addition of small amounts of rare earth metals tends to stabilise the oxide and prevent cracking and spalling. This higher degree of stability is found to decrease hydrogen permeation by up to four orders of magnitude.

8013 **A dynamic ion beam method for measuring deuterium diffusion in films.** Cowgill, D.F. (Sandia National Laboratories, Albuquerque, NM 87185). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-28: No. 2, 1851-1854(Apr 1981). (CONF-801111—).

From 6. conference on application of accelerators in research and industry; Denton, TX, USA (3 Nov 1980).

A new technique is described for the measurement of deuterium diffusion in metal films. Deuterium is ion-beam implanted in the film and simultaneously observed to diffuse to the film's surface by means of the D(d,p)T nuclear reaction. The buildup of deuterium in the near-surface area is modeled and shown to be controlled by migration to depths deeper than the deuteron range (the undamaged region) as well as by migration in the ion-damaged region. Diffusion normal to the film may be measured selectively in each region by choosing appropriate combinations of implant flux, ion energy, film thickness, and target temperature. An advantage to the technique over permeation-type measurements is that surface effects are easily eliminated. The diffusion of deuterium in scandium and scandium deuteride was measured between 12°C and 250°C. Time-dependent D(d,p)T yields were obtained for 0.5 to 5.5 μm thick films using 40 keV bombardment (deuteron range about 0.4 μm) with fluxes to 1.5 mA/cm^2. Diffusion was first observed in α-phase scandium. As the deuterium concentration increased, transition to the hydride phase was clearly visible. Subsequent data gave diffusivities for the mixed phase region, which agree well with previous NMR measurements in bulk ScH_2. The α-phase measurements appear more than an order-of-magnitude greater than the mixed-hydride phase but described by the same activation energy for diffusion. No damage-dependent effects are observed for these bombardment conditions.

8014 **Increase of the electrical resistance of thin copper film due to 14 MeV neutron irradiation.** Agrawal, S.K.; Kumar, U.; Nigam, A.K.; Singh, S.P. (Banaras Hindu University, Varanas - 221005). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-28: No. 2, 1866-1868(Apr 1981). (CONF-801111—).

From 6. conference on application of accelerators in research and industry; Denton, TX, USA (3 Nov 1980).

The variation in the electrical resistance of thin copper film (500 A° thick), grown on the glass slide has been measured with increasing 14 MeV neutron irradiation time. The electrical resistance vs irradiation time curve shows an interesting behaviour after

an irradiation of 40 minutes. However, there is a net increase in the electrical resistance with increasing neutron dose. The maximum increase in the observed electrical resistance after an irradiation of 115 mins, is 4.45%. The microstructural studies of irradiated film were made using TEM & TED techniques. The TEM patterns up to an irradiation time of 1.00 hr do not show any appreciable change in the microstructure. The TED patterns also do not show any appreciable change in the diffraction pattern up to an irradiation time of 1.0 hr. But after an irradiation time of 1.5 hrs, two extra rings appear in the TED pattern which disappear with increasing neutron irradiation time.

8015 **The use of ion beam techniques in catalysis.** Cairns, J.A. (Harwell Catalyst Unit, AERE Harwell, Didcot, Oxfordshire, OX11 ORA). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 2, 1804-1807(Apr 1981). (CONF-801111—).

From 6. conference on application of accelerators in research and industry; Denton, TX, USA (3 Nov 1980).

It has become increasingly obvious recently that ion beam methods can make a significant contribution to the preparation and characterisation of heterogeneous catalysts. Normally such catalysts are composed of one or more metals or compounds dispersed over a high surface area support material, such as alumina or silica. It is important to be able to measure the relative concentrations of the catalytic components (and any associated impurities) over the support, and, to some extent, within the support. Proton Induced X-ray Emission is particularly appropriate for this purpose. It may be used also to identify the presence of poisoning elements which have been responsible for catalyst deactivation. However, one of the most common causes of catalyst deactivation is carbon deposition on to its exposed surfaces. In this case, a particularly useful diagnostic technique is Prompt Nuclear Activation Analysis, since it can be rendered specific for carbon to the exclusion of other associated elements. So far as catalyst preparation is concerned, there are of course many conventional chemical routes: for example, these may involve impregnating the support with suitable catalytic metal salts, thereby utilising the high surface area properties of the support to create the dispersion of the catalytic elements. However, it has now been realised that two ion beam techniques, namely ion implantation and sputtering, provide an alternative method of producing novel catalysts.

8016 **Application of ion implantation in metals & alloys.** Dearnaley, G. (AERE Harwell, OX11 ORA). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 2, 1808-1811(Apr 1981). (CONF-801111—).

From 6. conference on application of accelerators in research and industry; Denton, TX, USA (3 Nov 1980).

Ion implantation first became established as a precise method of introducing dopant elements into semiconductors. It is now appreciated that there may be equally important applications in metallic tools or components with the purpose of improving their resistance to wear, fatigue or corrosion. Nitrogen ions implanted into steels pin dislocations and thereby harden the metal. Some metallic ions such as yttrium reduce the tendency for oxidative wear. There is a fairly good understanding of how both treatments can provide a long-lasting protection that extends to many times the original depth of implantation. Nitrogen implantation also improves the wear resistance of Co-cemented tungsten carbide and of hard chromium electroplated coatings. These treatments have wide application in press tools, molds, dies and other metal-forming tools as well as in a more limited variety of cutting tools. Some striking improvements can be achieved in the corrosion field, but there are economic and technical reasons for concluding that practical applications of ion implantation will be more restricted and specialized in this area. The most promising area is that in which mechanical stress and oxidation coexist. When a metallic species has to be introduced, a promising new development is to bombard a thin coating of the metal at an elevated temperature. Several powerful mechanisms of radiation-enhanced diffusion can bring about a complete intermixing. Examples of how this has been used to produce wear resistant surfaces in titanium are given. Finally, the equipment developed for the large scale application of the ion implantation process in the engineering field is described.

8017 **The effect of ion implantation on the fatigue behavior of metals and alloys.** Chakrabortty, S.B.; Kujore, A.; Legg, K.O.; Starke, E.A. (Georgia Inst. of Technology, Atlanta, Georgia 30332). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 2, 1812-1815(Apr 1981). (CONF-801111—).

From 6. conference on application of accelerators in research and industry; Denton, TX, USA (3 Nov 1980).

The effect of ion implantation on the strain and stress controlled fatigue behavior of polycrystalline copper has been investigated. The cyclic stress-strain response, strain-life and stress-life relationships and fatigue crack nucleation behavior have been studied. The results from the non-implanted materials have been compared with those from the implanted materials. Four implant species, one with a positive misfit, one with a negative misfit, one with a zero misfit, and one insoluble under equilibrium conditions have been used. Most of the fatigue tests were performed in laboratory air. Ion implantation changes the surface deformation behavior for both monotonic and cyclic loading with a corresponding change in hardening rate. Larger changes are observed for the cyclic loading. Implantations which lead to a more homogeneous deformation (fine slip) near the surface, improves the resistance to fatigue crack initiation. Surface compressive residual stresses, induced from implanting a positive misfit species, have a major influence on crack initiation in the stress-life regime.

3602 Ceramics, Cermets, And Refractories

REFER ALSO TO CITATION(S) 7262, 7331, 8179

8018 **(BMFT-FB-T—83-166) Influence of temperature on fracture behaviour and mechanical properties of hot-pressed silicon nitride with different sintering aids.** Kriz, K.; Ilschner, B. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Jul 1983. 47p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84750051.

In a 2-year program, methods have been developped with the aim to complement conventional fracture strength measurements by fracture mechanical data, which are more characteristic for a special material. For this purpose, two different types of HPSN containing different sintering aids (MgO and Y_2O_3, resp.) have been tested in the temperature range up to 1400°C. While basic investigations into the fracture behaviour and crack propagation mechanisms represent the main points of this work, fracture toughness, elastic constants and attenuation parameters were also determined. A double-torsion testing machine was designed, constructed and calibrated. First results concerning slow crack growth below 1000°C are presented. The results show that the Y_2O_3 doped material compares favourably with the MgO doped HPSN with respect to fracture; it is suggested that this is due to a stronger interlocking of neighbouring grains, and to the higher m.p. of the intergranular phase. The lowest value of Ksub(I), characterizing the onset of cracking, was found to be 6 MNmsup(-3/2) at 1300°C. If the scatter band of the mechanical properties, still being fairly wide, could be reduced, the potential for application of this ceramic in structural components for high temperature service may be extended.

8019 **(CEA-CONF—6633) Magnetic form factor studies of actinide compounds.** Blaise, A.; Founier, J.M.; Boeuf, A.; Delapalme, A.; Forte, M. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Oct 1982. 8p. (CONF-821057—6). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704109.

From International conference on the impact of polarized neutrons on solid state chemistry and physics; Grenoble, France (15 Oct 1982).

Some results obtained at ILL on Actinide compound form factors are reviewed. In the paramagnetic NpO_2 single crystal (5mg), an induced magnetic moment of 0.07μsub(B) was obtained at 4.2K (4.6T). In the ferromagnetic phase of $NpAs_2$ single crystal (0.2mm³), the magnetic moment (1.46μsub(B)/Np atom) has been found fixed along the [001] direction. In both cases, the Np form factors fit satisfactorily the Np^{4+} form factor calculated with rela-

tivistic atomic wave functions. The Fermi length for Np was deduced (b(Np) = 1.015(15)10^{-13}cm). In the paramagnetic Laves phase UNi_2 compound, equally small moments are observed on U atom (0.013(1)μsub(B)) and on Ni atom (0.016(1)μsub(B)) confirming important changes in 3d band structure of Ni by hybridization with U electrons.

8020 **(CEA-R—5197) Oxygen redistribution in (UCe)Osub(2-x).** Guedeney, Philippe. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France); Paris-11 Univ., 91 - Orsay (France)). 1983. 112p. (In French). NTIS (US Sales Only), PC A06/MF A01. Order Number DE83704112.

Redistribution of oxygen has been investigated in (Usub(0,7)Cesub(0,3))Osub(2-x) mixed oxide subjected to a temperature gradient in laboratory experiments, in order to apply the results to the nuclear fuel (UPu)Osub(2-x). Cylindrical sintered oxide specimens were exposed to temperature up to 1300°C with a longitudinal thermal gradient of about 400°C/cm. The most interesting feature of the experimental set-up is a solid-state electrochemical gauge (ThO_2 - Y_2O_3), placed in the cold part of the sample which allows a continuous measurement of the oxygen activity. The experiments showed a fast oxygen migration down the thermal gradient. The calculations performed with a model based on solid-state thermodiffusion are in good agreement with experimental results. The heat of transport Q measured for bare samples reaches (7.2+-0.5)-kcal/mole. When the sample is coated with a tight fitting metallic cladding, an extra term Qe has to be added to the heat of transport Qe. This was interpreted as an electrotransport phenomena. On the same basis, calculations applied to radial oxygen redistribution in (UPu)Osub(2-x) seem to be adequate at least during the first stage of irradiation, taking Q=(20+-5)kcal/mole.

8021 **(CONF-821268—1) Mechanical behavior of ZrO_2 toughened Al_2O_3.** Becher, P.F. (Oak Ridge National Lab., TN (USA)). 1982. Contract W-7405-ENG-26. 15p. NTIS, PC A02/MF A01. Order Number DE84004677.

From Tokyo Institute of Technology symposium on zirconia ceramics; Yokohama, Japan (7 Dec 1982).

Recent studies on mechanisms to increase the critical fracture toughness (K/sub IC/) of ceramics have led to the development of high tensile strength (up to 1000 MPa, ~ 150,000 psi as measured in a four-point flexure test) Al_2O_3-ZrO_2 composite materials with high K/sub IC/ values (8 to 13 MPa m/sup 1/2/). These toughness levels are two- to three-fold greater than those of the toughest conventional ceramics. In addition these composites exhibit much better resistance to static fatigue than do alumina ceramics. (< 1 μm) tetragonal ZrO_2 particles partially stabilized with Y_2O_3 in a polycrystalline ceramic matrix (e.g., alumina). The processing of such composite ceramics utilizes sol-gel techniques which allows one to obtain a much more uniform dispersion of very fine (submicron) second phase particles as well as to control both the grain size and compositional uniformity of the ceramic. Experimental toughening results show that compositional control and microstructure are critical to the extent of increased toughening that can be achieved.

8022 **(DOE/ER/10866—3) Dynamical friction in condensed matter. Progress report, April 15-December 15, 1983.** Sokoloff, J.B.; Perry, C.H. (Northeastern Univ., Boston, MA (USA)). Dec 1983. Contract AC02-81ER10866. 32p. NTIS, PC A03/MF A01. Order Number DE84004202.

Portions are illegible in microfiche products.

The problem of non-linear electrical conductivity due to motion of charge density waves in crystal lattices under an applied field is a microscopic model system exhibiting friction-like phenomena. Two unexplained experimental results in this system are the occurrence of narrow band noise for dc electric field above the threshold for charge density wave sliding and the observed occurrence of metastability in the charge density wave contribution to the electrical conduction. Studies are described on IR and Raman spectroscopy of high temperature phase transitions in non-stoichiometric zirconia-yttria mixed crystals, inelastic and diffuse elastic neutron scattering of cubic zirconia, infrared and Raman spectra of potassium hollandite, and Raman investigations of graphite intercalated with AsF_5 and $SbCl_5$. (WHK)

8023 **(DOE/ER/10870—144) Distribution of activation energies in Zr_2PdH/sub x/.** Hazelton, L.; Johnson, W.L. (California Inst. of Tech., Pasadena (USA). W.M. Keck Lab. of Engineering Materials). Sep 1983. Contract AT03-81ER10870. 8p. NTIS, PC A02/MF A01. Order Number DE84004742.

Internal friction measurements were made on glassy $Y_{64}Fe_{36}$, Zr_3Pd, and $Zr_2PdH_{2.6}$. It was found that the broadened, asymmetric peaks in $Zr_2PdH_{2.6}$ were probably due to a distribution of activation energies E/sub a/ for hydrogen hopping. The $Zr_2PdH_{2.6}$ peak was deconvoluted and a model proposed to explain the low energy tail of the distribution.

8024 **(DOE/ER/12076—T1) Migration of grain boundaries in ceramic materials with particular reference to the sintering process. Technical progress report for the second year, 15 January 1983-14 December 1983.** Carter, C.B. (Cornell Univ., Ithaca, NY (USA)). 14 Dec 1983. Contract AC02-82ER12076. 9p. NTIS, PC A02/MF A01. Order Number DE84004086.

The areas of research covered by this program are TEM studies of faceted interfaces in Al_2O_3 and Mg-Al spinel; the morphology of Al_2O_3 polycrystalline compacts and the relation to grain boundaries in Al_2O_3; and the structure, dissociation and migration of grain boundaries in Si and Ge.

8025 **(INIS-BR—94) Study of the degradation of the mechanical resistance of an alumina.** Xavier, C. (Instituto Militar de Engenharia, Rio de Janeiro (Brazil)). Feb 1981. 95p. (In Portuguese). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84700207.

The strength degradation of a commercial, pure aluminum oxide was investigated in aqueous environment and at ambient temperature in static and dynamic loading, and the applicability of proof testing was studied. The fatigue parameters A and N of the basic equation of subcritical crack growth in ceramics, a sup(.)AK sup(N) sub(I), where a sup(.) is the crack growth rate and K sub(I) is the applied stress intensity factor, were determined from static and dynamic fatigue data using a numerical analysis method based on fracture statistics and fracture mechanics principles which has been published recently. (A.R.H.).

8026 **(LBL—16839) Mechanics of microcrack toughening in ceramics.** Fu, Y. (Lawrence Livermore National Lab., CA (USA)). Sep 1983. Contract AC03-76SF00098. 129p. NTIS, PC A07/MF A01. Order Number DE84004638.

Thesis.

The formation of a crack tip process zone consisting of stress induced microcracks has been observed to modify the fracture toughness of a material. In single phase polycrystalline ceramics with microstructural residual stresses due to thermal contraction anisotropy, the grain size dependence of fracture toughness is attributed to the microcrack toughening effect. Associated with the process are several unique features; namely, the microstructural threshold for the onset of microcrack toughening and an R-curve characteristic. A theoretical analysis of the mechanics of microcrack toughening, parallel to that conducted by Budiansky et al for transformation toughening, is conducted, whereupon the basis of these unique features are established.

8027 **(SAND—83-1062C) Line broadening studies on highly defective TiO_2 produced by high pressure shock loading.** Morosin, B.; Graeber, E.J.; Graham, R.A. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 10p. (CONF-830887—2). NTIS, PC A02/MF A01. Order Number DE84004065.

From Joint meeting of American Crystallographic Association and Denver X-ray conference; Snowmass, CO, USA (1 Aug 1983).

Enhanced solid state reactivity of materials both during and after shock compression has been attributed to the introduction of large numbers of defects into the crystalline lattices and to reduction in the particle and crystalline size of powders. In particular, orders of magnitude increases in the catalytic activity has been observed in shock-modified TiO_2. Line broadening of x-ray diffraction

profiles provides a means to determine the coherent crystallite size and the residual lattice strain resulting from defect concentrations. The present study on shock-loaded rutile is a detailed investigation of the influence of shock loading on residual lattice strain and coherent crystallite size. Annealing of shock-modified rutile powders is also studied.

8028 **Photoionization of oxidized metal clusters.** Dao, P.D.; Peterson, K.I.; Castleman, A.W. Jr. (Department of Chemistry, The Pennsylvania State University, University Park, Pennsylvania 16802). *Journal of Chemical Physics;* **80**: No. 1, 563-564(1 Jan 1984).

Oxidized metal clusters (Na/sub x/O and K/sub x/O for 2< or =x< or =4) were formed in a gas phase reaction between metal clusters and an oxidizing gas using a double expansion technique. Their appearance potentials were measured using a molecular beam-photoionization mass spectrometer system. These first photoionization data for oxidized clusters provide information on trends of ionization potentials as a function of the degree of aggregation. The ionization potentials do not differ greatly from the analogous metallic species, but in the case of the sodium tetramer the value does fall below that of the bare metal cluster. This finding is in accord with what has been observed as an influence of impurities on the work function of the bulk sodium. The results are also of interest concerning questions of octet rule violations and hypervalency.

8029 **EPR power pattern analysis for cubic sites of Fe^{3+} in MgO.** Boldu, J.L.; Munoz P., E.; Chen, Y.; Abraham, M.M. (Instituto de Fisica, U.N.A.M., Apartado Postal 20-364, 01000 Mexico). *Journal of Chemical Physics;* **80**: No. 1, 574-575(1 Jan 1984). Contract W-7405-ENG-26.

A complete electron paramagnetic resonance power pattern characterization of Fe^{3+} in cubic sites in presented. A one-to-one correspondence among the peaks appearing in the powder pattern and the outer fine-structure transitions (Mnot = 1/2) observed in the single crystal along the <100>, <111>, and <110> directions is shown. It is shown that the process of mechanically grinding the single crystal to a powder (particle size ~1—10 μ) does not remove the cubic symmetry sites. No axial or lower symmetry sites which may be induced by lattice distortion of the crystallites due to strain have been observed.

8030 **Soft-x-ray photoelectron-yield spectrum of InP(110) from 65 to 195 eV.** Rosenberg, R.A.; LaRoe, P.R.; Rehn, V.; Loubriel, G.M.; Thornton, G. (Michelson Laboratory, Physics Division, Naval Weapons Center, China Lake, California 93555). *Physical Review* [*Section*] *B: Condensed Matter;* **28**: No. 10, 6083-6085(15 Nov 1983).

The yield of electrons with 4-eV kinetic energy from vacuum-cleaved InP(110) in the photon-excitation range 65 to 195 eV is reported. The broad peak near 88 eV is assigned to a delayed onset of the In(4d→4f) transition. Spectral features in the range 129—180 eV are caused by excitation of the P(L/sub II,III/) electrons. The binding energy of the P(L/sub II/) and P(L/sub III/) electrons is determined to be 134.0 +- 0.2 and 133.0 +- 0.2 eV, respectively, below the vacuum level. Weak features associated with In(N/sub I/) and P(L/sub I/) excitations are also reported.

8031 **Photosensitivity enhancement of PLZT ceramics by positive ion implantation.** Land, C.E.; Peercy, P.S. (to Dept. of Energy). US Patent 4,391,901. 5 Jul 1983. Filed date 28 Jan 1982. vp.

PAT-APPL-343612.

The photosensitivity of lead lanthanum zirconate titanate (PLZT) ceramic material used in high resolution, high contrast, and non-volatile photoferroelectric image storage and display devices is enhanced significantly by positive ion implantation of the PLZT near its surface. Implanted ions include H^+, He^+, Ne^+, Ar^+, as well as chemically reactive ions from Fe, Cr, and Al. The positive ion implantation advantageously serves to shift the absorption characteristics of the PLZT material from near-UV light to visible light. As a result, photosensitivity enhancement is such that the positive ion implanted PLZT plate is sensitive even to sunlight and conventional room lighting, such as fluorescent and incandescent light sources. The method disclosed includes exposing the PLZT plate to the positive ions at sufficient density, from 1 X 10^{15} to 1 X 10^{17}, and with sufficient energy, from 100 to 500 KeV, to provide photosensitivity enhancement. The PLZT material may have a lanthanum content ranging from 5 to 10%, a lead zirconate content of 62 to 70 mole %, and a lead titanate content of 38 to 30%. The ions are implanted at a depth of 0.1 to 2 microns below the surface of the PLZT plate.

8032 **Faceting of tilt boundaries in NiO.** Vaudin, M.D.; Ruhle, M.; Sass, S.L. (Department of Materials Science and Engineering, Cornell University, Ithaca, NY 14853). *Acta Metallurgica;* **31**: No. 7, 1109-1115(Jul 1983). Contract AC02-76ER02899;AC02-81ER10956.

The structure of low angle tilt boundaries in NiO was studied using an electron microscope technique that is sensitive to the change in mean inner potential at the core of dislocations. The two boundaries examined were both faceted, one in particular having a complex dislocation content in facets with a period of about8.8 nm. Using the experimentally determined rotation axis, angle and boundary plane, Bollmann's O-lattice theory was applied to determine the geometry and dislocation content of the facets. The predictions of the theoretical analysis were in excellent agreement with all details of the observed geometry and dislocation content, demonstrating that Bollmann's theory is valid to predict the detailed structure of tilt boundaries in NiO. It is suggested that in NiO a tilt boundary with an arbitrary rotation axis will be faceted.

8033 **High resolution electron microscopy of sintered AlN.** Van Tendeloo, G.; Thomas, G. (Lawrence Berkeley Lab., CA). pp 546-547 of 40th annual proceedings of the Electron Microscopy Society of America. Bailey, G.W. (ed.). Washington, DC; Electron Microscopy Society of America (1982). Contract W-7405-ENG-48.

A low-magnification photograph shows the microstructure of sintered AlN-10% SiO_2 to be similar to that of sintered SiC. A high-resolution micrograph of AlN reveals a 11-layer periodicity corresponding to a 33R structure. (DLC)

8034 **Sintering of α-Al_2O_3/quartz, and α-Al_2O_3/cristobalite related to mullite formation.** Rana, A.P.S.; Aiko, O.; Pask, J.A. (Lawrence Berkeley Lab., CA). *Ceramics International;* **8**: No. 4, 151-153(1982). Contract W-7405-ENG-48.

Cristobalite and quartz react differently in mixtures with α-Al_2O_3 at 1415°C. With cristobalite, an eutectic liquid forms in accordance with the metastable phase equilibrium diagram for α-Al_2O_3-SiO_2 (cristobalite) in the absence of mullite. With quartz, a liquid first forms on the surfaces of quartz because of the occurrence of an intermediate liquid phase on transformation of quartz to cristobalite. These liquids act as precursors to the formation of mullite by reacting with α-Al_2O_3. Mullite was detected earlier in the cristobalite-containing mixtures under similar firing conditions because the growth of mullite becomes significant with the formation of the eutectic liquid at the α-Al_2O_3-cristobalite interface since it is already saturated with Al_2O_3. The kinetics of sintering are affected by the rates of the step reactions.

3603 Composite Materials

8035 (NBSIR—83-1690, pp 361-367) **Variability in mechanical performance of G-10CR cryogenic-grade insulating laminates.** Kasen, M.B.; Schramm, R.E. (National Bureau of Standards, Boulder, CO). May 1983. NTIS, PC A19/MF A01.

In Materials studies for magnetic fusion energy applications at low temperatures - VI.

An assessment is made of the variability in cryogenic mechanical performance of insulating laminates produced by five manufacturers to a common component and procedure specification. Results at 295 K and 76 K indicate that the specification is adequate to ensure the desired degree of product uniformity.

8036 (NBSIR—83-1690, pp 369-374) **Effect of cryogenic temperatures on the mechanical performance of glass-fabric-reinforced epoxy and polyimide matrix laminates.** Kasen, M.B.; Schramm, R.E.; Kriz, R.D. (National Bureau of Standards, Boulder, CO). May 1983. NTIS, PC A19/MF A01.

In Materials studies for magnetic fusion energy applications at low temperatures - VI.

Radiation-resistant laminates are required for insulators and structural supports in the superconducting magnets of magnetic fusion energy systems. Glass-reinforced laminates fabricated with a polyimide matrix have a much higher tolerance to neutron and gamma radiation at 4 K than do laminates fabricated with an epoxy matrix. However, tests indicate that the mechanical performance of polyimide-matrix laminates is inferior to that of the epoxy type, whereas their elastic performance is superior. Fractographic studies show that the performance difference is due to a lower integrity of the polyimide-glass interface.

8037 (NBSIR—83-1690, pp 375-384) **Elastic stiffness and local stresses in woven-fabric composites at 77 K.** Kriz, R.D. (National Bureau of Standards, Boulder, CO). May 1983. NTIS, PC A19/MF A01.

In Materials studies for magnetic fusion energy applications at low temperatures - VI.

Woven-fabric composites are commonly used in superconducting magnets and in containment of cryogenic liquids. Here, the mechanical response of a plain-weave laminated composite at cryogenic temperatures is studied by predicting the load-deformation response of a fundamental unit cell. The unit cell is the smallest repeating geometrical structural unit such that 90-degree rotations about the axis normal to the fabric plane yield four identical patterns. The model assumes that generalized plane strain exists on all four faces of the unit cell. Hence the elastic response of the unit cell can be predicted by studying the three-dimensional load-deformation response within a single plane parallel to the load direction. Stiffness and stresses within this plane are calculated for worst-case load conditions prior to fracture. A finite-element model is used to predict unit-cell stresses and stiffnesses.

8038 (NBSIR—83-1690, pp 385-413) **Influence of ply cracks on fracture strength of graphite/epoxy laminates at 76 K.** Kriz, R.D. (National Bureau of Standards, Boulder, CO). May 1983. NTIS, PC A19/MF A01.

In Materials studies for magnetic fusion energy applications at low temperatures - VI.

Quasi-isotropic laminates ([0/90/ +- 45]/sub s/; [0/ +- 45/ 90]/sub s/) were fabricated from graphite/epoxy and quasi-statically loaded in tension at 76 K until fracture occurred. Fibers in 0° plies carry the largest portion of the tensile load; the weaker 90° and 45° plies crack at loads much lower than fracture strength. The effect of ply crack on fracture of load-bearing 0° plies was examined to understand how defects affect laminate strength. A generalized plane-strain finite-element model was used to predict stress gradients in the 0° ply near the crack tip. Variations in residual stress caused by changes in temperature and absorbed moisture were included in the analysis. The experiments indicated that absorbed moisture significantly alters the fracture strength and fracture surface of a dehydrated [0/90 +- 45]/sub s/ laminate tested at 76 K. The 0° plies of dehydrated laminates fractured along several 90° ply cracks. When moisture saturated a [0/90/ +- 45]/sub s/] laminate, a single 90° ply crack dominated the fracture of the 0° ply and the laminate fracture strength decreased 8 percent. Analysis of residual stresses indicated a higher residual stress state existed near the 90° ply crack when moisture was absorbed.

8039 (NBSIR—83-1690, pp 429-454) **Calculated elastic constants of composites containing anisotropic fibers.** Datta, S.K. (Univ. of Colorado, Boulder); Ledbetter, H.M.; Kriz, R.D. May 1983. NTIS, PC A19/MF A01.

In Materials studies for magnetic fusion energy applications at low temperatures - VI.

By a wave-scattering method, we derive dispersion relationships for waves propagating perpendicular to continuous fibers that are oriented unidirectionally. In the long-wavelength limit one obtains relationships that predict the composite's effective static elastic constants. We compare these relationships with others derived by energy methods to obtain upper and lower bounds of the effective static moduli. We demonstrate them graphically by plotting for graphite-epoxy the predicted composite constants over the full range of fiber volume fractions. We consider the fibers to be anisotropic, but transversely isotropic. Under special conditions, the energy-method upper and lower bounds compare identically with the results of this study. The static properties are, of course, special cases of the more general dispersion relationships. Graphs are given for nine elastic constants: axial and transverse Young's and shear moduli, bulk and plane-strain-bulk moduli, and three Poisson's ratios.

8040 **Thermal diffusivity of in situ composites.** Ostenson, J.E.; Finnemore, D.K.; Verhoeven, J.D.; Gibson, E.D.; Shanks, H.R. (Ames Laboratory-USDOE, Department of Physics and Department of Materials Science and Engineering, Iowa State University, Ames, Iowa 50011). *Journal of Applied Physics;* **55**: No. 1, 278-279(1 Jan 1984). Contract W-7405-ENG-82.

The thermal and electrical transport properties for Cu-Nb metal-metal composites have been measured in order to determine the suitability of these materials for high strength structural members where high thermal conductivities are needed. In the temperature range between zero and 400 °C the thermal diffusivity of the cold drawn alloy is about 10% less than annealed Cu. The rule of mixtures, in fact, describes the data well.

8041 **Moisture distribution measurements in adhesive-bonded composites using the D (^{3}He,p)^4 He reaction.** Schulte, R.L.; Deiasi, R.J. (Gruman Aerospace Corp., Bethpage, New York 11714). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 2, 1841-1844(Apr 1981). (CONF-801111—).

From 6. conference on application of accelerators in research and industry; Denton, TX, USA (3 Nov 1980).

Adhesive bonding of composite materials for many aircraft components offers a distinct advantage in weight and cost reduction compared to similar structures that have been joined by riveting. However, the long term performance of adhesive-bonded components depends on the degree and rate of moisture absorption by the adhesive in the service environment. To investigate the rate and the mechanism of water transport in adhesive-bonded composite materials, a nuclear reaction analysis method based on the D(^{3}He,p)^{4}He reaction is used to measure the moisture distributions. Samples of graphite/epoxy composite materials were bonded with an epoxy adhesive and isothermally conditioned in a controlled D_2O environment at 70% relative humidity and 77°C for various exposure times. The moisture profiles were measured along the adhesive (adhesive scan) as well as through the thickness of the bonded joint (transverse scan). The dimensions of the probing beam were 125 μm x 125 μm for the adhesive scan and 25 μ x 200 μm for the transverse scan. Absolute deuterium concentrations were determined by comparison of the proton yield from the composite/adhesive to that from reference standards. Calculations from diffusion models of water transport based on parameters determined from bulk measurement techniques are compared to the measured profile and the agreement indicates that classical Fickian diffusion describes the transport of moisture in these materials.

3604 Polymers And Plastics

REFER ALSO TO CITATION(S) 7192, 7192, 7192, 7648, 8264, 8283, 8283

8042 **(CONF-840247—1) XPS analysis of amine plasma-treated polyaramid filaments.** Allred, R.E. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 4p. NTIS, PC A02/MF A01. Order Number DE84003759.

From Ahesion Society annual meeting; Jacksonville, FL, USA (13 Feb 1984).

Portions are illegible in microfiche products.

XPS spectra were obtained from 10 mm diameter pellets of aramid model compounds and Kevlar 49 (poly(p-phenylene terephthalamide), PPTA) fabrics before and after rf glow discharge ammonia-plasma treatment. The line shape changes are consistent

with those taken from aramid model compunds containing primary amine groups or after ammonia-plasma exposures, and suggest that a portion of the nitrogen present on the PPTA surface after ammonia-plasma treatment is in the form of primary amines. The plasma-treated surface does not have a complex structure with nitrogen oxides, etc., nor is it representative of bulk PPTA. The modified surface appears as a fused hydrocarbon network over the bulk PPTA structure with only two types of nitrogen.

8043 **(SI-R—820808-1) Offshore use of plastics.** Slotfeldt-Ellingsen, D.; Malmo, J. (Sentralinstitutt for Industriell Forskning, Oslo (Norway)). Oct 1982. 48p. (In Norwegian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84750117.

The report refers international, Norwegian and British regulations and legislation concerning requirements for the materials and products used in offshore with potential safety consequences. The fire technical requirements in particular, are considerably stricter than for similar constructions ashore. Today this limits the use of plastic at offshore platforms and other structures. The main application fields are: Steel corrosion protection, pipe systems, glasfibre reinforced unsaturated polyester (GUP) parts particularly in electrical installations, casing (little), buoys and breakers (little), buoyancy aids, thermoinsulation, fenders, life saving equipment, submarine vessels, concrete repair, flexible components and hoses, internal work (little), packing (little), ropes, anti-erosion installations on the sea bed (little), insulating electrical cables, polymer thickening aids used for increasing reservoar exploitation efficiency and oil protection equipment. The various types of plastics mainly used in the fields are mentioned. There are possibilities for considerable increase in the use of plastics also in new fields, if the price, function and safety are good and are documented properly: fibre reinforced, fire - retardant plastic in pipe systems,corrosion protection and foam in buoyancy aids.

8044 **Unusual chemical composition fluorescers and filters for low-energy x-ray diagnostics. Part I. Oxygen compositions.** Jorgensen, B.; Liepins, R.; Day, R.H. (University of California, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Review of Scientific Instruments;* 55: No. 1, 35-38(Jan 1984).

The preparation of filters and fluorescence of high oxygen content (53%) for low-energy x-ray measurements is described. The thin films of high oxygen content were fabricated from a 50:50 wt. % mixture of Celcon/sup T//sup M/ and Delrin/sup T//sup M/. Thermal analysis data on all the materials investigated are also presented.

8045 **Semiconducting polymers.** Hermann, A.M. (Solar Energy Research Inst., Golden, CO). *Applied Physics Communications;* 3: No. 1 & 2, 59-82(1983).

Investigation of electronic transport in polymers has increased significantly over the last thirty years. There are now several books and numerous reviews devoted to polymeric conductors. The conductivities measured range from the unmeasurably low values of polymeric insulators (e.g., polyethylene) to unmeasurably high values of polymeric super conductors (e.g., SN/sub x/ and complexes thereof). We present here a brief review of the electrical properties of polymers whose conductivities lie in the middle of this broad range, polymers which we denote as semiconducting. We confine our comments primarily to polymers in which conduction takes place through electronic (as opposed to ionic) transport. Particular emphasis is given to a wide range of applications involving semiconducting polymers.

8046 **Polymer laminate structures.** Sarjeant, W.J. (State Univ. of New York at Buffalo, Amherst); Rohwein, G.J.; Mauldin, G.H.; Bickford, K.J.; Springer, T.E.; Burkes, T.R. *Applied Physics Communications;* 3: No. 1 & 2, 83-167(1983).

The objective of this chapter on polymer laminates is to present a current database of their measured characteristics. With the advent of expanding applications at high voltages and temperatures in aeroplanes and spacecraft systems such as lasers, a compilation of high voltage laminate data is of some utility. Experiments have shown that long lifetime operation to date has generally required impregnation of the laminate structure with an insulating liquid dielectric of specific properties. For the purposes of describing progress in this difficult and demanding area, the content of this chapter will emphasize characteristics of liquid impregnated polymer laminate structures.

8047 **Structural characterization of semicrystalline polymer blends by small-angle neutron scattering.** Wignall, G.D. (Oak Ridge National Lab., TN); Child, H.R.; Samuels, R.J. *Polymer;* 23: 957-964(Jul 1982). Contract W-7405-ENG-26.

A series of phase-separated polyethylene-polypropylene blends, which have undergone different thermal treatments, have been analyzed by small-angle neutron scattering (SANS). The coherent scattering from normal hydrogenated blends is virtually zero, but strong contrast may be induced by partial or complete deuteration (labelling) of either phase. Here, the scattering from blends with complete labelling of the polyethylene phase was analyzed to provide the domain dimensions by means of a theory due to Debye using an exponential correlation function. By this means the mean chord intercept lengths of both phases were shown to be in the range 1000 to 10,000 A. The scattering from blends with partial labelling of the polyethylene was analyzed to give the radius of gyration of the molecules in the polyethylene domains, which was found to be close to that measured in the homopolymer. For melt-quenched blends the deuterated polyethylene was shown to be statistically distributed in the polyethylene phase, whereas for slow-cooled blends, partial segregation of the labelled molecules occurred.

8048 **High resolution spectroscopy of the carbon K edge in polymers with a doppler tuned x-ray spectrometer.** Brenn, R.; Haralambidis, D. (Fakultat fur Physik der Universitat, D-7800 Freidburg). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-28: No. 2, 1207-1209(Apr 1981). (CONF-801111—).

From 6. conference on application of accelerators in research and industry; Denton, TX, USA (3 Nov 1980).

X-rays emitted by fast ion beams can be Doppler tuned by variation of the observation angle. With X-ray detectors collimated to a narrow acceptance angle high resolution spectroscopy of absorption structures of gaseous or solid absorbers can be performed. This novel technique seems useful in the soft X-ray region (e.g., K absorption edges of carbon to oxygen) where conventional (crystal or grating at grazing incidence) monochromators suffer from low transmission and moderate energy resolution. The authors studied the performance of a Doppler tuned X-ray monochromator in the carbon K region using 7.5 to 11.5 MeV carbon beams excited by gas or beam foil collisions. With X-ray detectors collimated to 1° angular acceptance the calculated monochromator band width at the carbon K edge of polymer foil absorbers becomes $\Delta E < 0.1$ eV for 7.5 MeV beam energy. The purpose of these measurements is the study of the near structure (position, width and structural details) of the carbon K edge in polymers at high resolution as a function of chemical composition.

8049 **An update on irradiation of wire and cable.** Hildreth, N. (Haveg. Industries Inc., Wire & Cable Division, P.O. Box 7, Winooski, Vermont 05404). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-28: No. 2, 1794-1796(Apr 1981). (CONF-801111—).

From 6. conference on application of accelerators in research and industry; Denton, TX, USA (3 Nov 1980).

Radiation curing with electron accelerators is a growing high technology application in the wire and cable industry. They are used with voltages ranging from 500,000 up to 3,000,000 electron volts. Furthermore new machines are available up to 5.0 MeV. These industrial machines are high powered accelerators which operate continuously between 60 and 75 kilowatts with a few of the new machines operating up to 200 kilowatts. Radiation curing is used as a tool for developing new insulation systems based on low cost materials for applications which previously required the use of expensive fluorocarbon or silicone rubber type insulations. With the development of the larger, more efficient and reliable accelerators and the continuous trend toward developing new insulations designed to fully utilize the potential of radiation chemistry, the au-

thors are confident that industry will continue to be provided with better, lower cost insulation systems.

8050 **Polystyrene fluorescence: effects of molecular weight in various solvents.** Torkelson, J.M.; Lipsky, S.; Tirrell, M. (Univ. of Minnesota, Minneapolis). *Macromolecules;* 14: 1601-1603(1981).

Because excimer formation occurs by the rotation of bonds to bring two adjacent chromophores into a coplanar arrangement, the ratio of excimer to monomer fluorescence intensity (I/sub E// I/sub M/) was used as a probe of the conformational transitions in these molecules. Four solvents were used in the studies.

3606 Other Materials

REFER ALSO TO CITATION(S) 7130, 7287, 7295, 7356, 8019, 8151, 8273

8051 **(CONF-821107—58) Time-resolved study of silicon during pulsed-laser annealing.** Larson, B.C.; White, C.W.; Noggle, T.S.; Barhorst, J.F.; Mills, D.M. (Cornell Univ., Ithaca, NY (USA); Oak Ridge National Lab., TN (USA)). Nov 1982. Contract W-7405-ENG-26. 9p. NTIS, PC A02/ MF A01. Order Number DE84003363.

From 6. international symposium on the scientific basis for radioactive waste management (Materials Research Society); Boston, MA, USA (1 Nov 1982).

Near-surface temperatures and temperature gradients have been studied in silicon during pulsed laser annealing. The investigation was carried out using nanosecond resolution x-ray diffraction measurements made at the Cornell High Energy Synchrotron Source. Thermal-induced-strain analyses of these real-time, extended Bragg scattering measurements have shown that the lattice temperature reached the melting point during 15 ns, 1.1 to 1.5 J/ cm^2 ruby laser pulses and that the temperature of the liquid-solid interface remained at that temperature of the liquid-solid interface remained at that temperature throughout the high reflectivity phase, after which time the surface temperature subsided rapidly. The temperature gradients below the liquid-solid interface were found to be in the range of 10^{70}C/cm.

8052 **(CONF-8203152—Absts.) Metallic glasses.** (Deutsche Gesellschaft fuer Metallkunde e.V., Oberursel (Germany, F.R.)). 1982. 81p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84770051.

From Meeting on metallic glasses; Augsburg, F.R. Germany (3 Mar 1982).

In the abstracts subjects are treated such as technology and applications of metallic glasses, magnetic properties, atomic structure and electronic structure, relaxation and structural changes, mechanical properties, as well as production and formation conditions.

8053 **(CONF-8308149—1) Neutron diffraction studies of natural glasses.** Wright, A.C.; Erwin Desa, J.A.; Weeks, R.A.; Sinclair, R.N.; Bailey, D.K. (Oak Ridge National Lab., TN (USA); Reading Univ. (UK); UKAEA Atomic Energy Research Establishment, Harwell. Materials Physics Div.). Aug 1983. Contract W-7405-ENG-26. 21p. NTIS, PC A02/MF A01. Order Number DE84003385.

From Conference on glass in planetary and geological phenomena; Alfred, NY, USA (14 Aug 1983).

A neutron diffraction investigation has been carried out of the structures of several naturally occurring glasses, viz. Libyan Desert glass, a Fulgurite, Wabar glass, Lechatelierite from Canon Diablo, a Tektite, Obsidian (3 samples), and Macusani glass. Libyan Desert sand has also been examined, together with crystalline α-quartz and α-cristobalite. A comparison of data for the natural glasses and synthetic vitreous silica (Spectrosil B) in both reciprocal and real space allows a categorisation into Silicas, which closely resemble synthetic vitreous silica, and Silicates, for which the resemblance to silica is consistently less striking. The data support the view that Libyan Desert glass and sand have a common origin, while the Tektite has a structure similar to that of volcanic glasses.

8054 **(DOE/ER/02754—9) Structure of glasses containing transition metal ions. Annual progress report, November 1, 1982-October 31, 1983.** White, W.B. (Pennsylvania State Univ., University Park (USA). Materials Research Lab.). 10 Dec 1983. Contract AC02-76ER02754. 21p. (COO—2754-9). NTIS, PC A02/MF A01. Order Number DE84004211.

This report describes a transitional period in the investigation of glass structure. The studies of network formation by Raman spectroscopy that occupied much of the efforts of previous years is now largely complete. The study of transition metal ions in alkali silicate glasses and the structural study of alkali-alumina-silica glasses were completed. Likewise, the study of hydration layers on glass surfaces was completed. The present report describes new studies on structure, phase separation, and the behavior of transition metal ions in alkaline earth-silicate glasses and on theoretical models for the thermodynamic behavior of glasses. In addition, the report describes on-going work on chromium in borate glasses and on the structural environment of alkali ions in alkali silicate glasses.

8055 **(DOE/ER/10485—T4) Studies of supported metal catalysts. Final report, September 1, 1979-April 30, 1984.** Hercules, D.M. (Pittsburgh Univ., PA (USA)). Apr 1984. Contract AC02-79ER10485. 13p. NTIS, PC A02/MF A01. Order Number DE84004210.

A variety of surface spectroscopic techniques, coupled with chemical activity measurements, has been used to study supported heterogeneous catalysts. The catalytic systems investigated are: Ni on Al_2O_3 and SiO_2, Co on Al_2O_3, Co and Zn on Al_2O_3, Mo on Al_2O_3, Mo in TiO_2, W on Al_2O_3, Co and Mo on Al_2O_3 and Ni and W on Al_2O_3. Emphasis has been on defining the nature of the surface species on the oxidic catalysts, prior to treatment or activation. Reaction of catalysts with H_2 and H_2S/H_2 have been used for diagnosing different species. Treatment with Ha2S/H_2 also has been used to elucidate the species on sulfided hydrotreating catalysts. Other aspects of the research involved evaluation of photoacoustic spectroscopy for studying catalysts and use of curve resolving techniques to maximize use of ESCA spectra for studying catalysts. In general, the species on catalysts with loadings below monolayer coverage are determined by the nature of the support. For example, on γ-Al_2O_3 distributions of the metal between tetrahedral (Td) and octahedral (Oh) sites occurs. Reactivity of metals in Oh and Td support sites differ; in Mo-Al_2O_3 catalysts, the metal in Td sites is reduced only to Mo(+5) by H_2 (500°C) but Oh Mo is reduced to Mo(+4). Sulfiding Mo/Al_2O_3 catalysts produces MoS_2 but leaves some metal unsulfided (Mo+5). Clear evidence for interaction species was found for ternary catalyst systems, viz. Co-Mo-Al_2O_3.

8056 **(DOE/ER/10740—12) Background research in support of the new grant proposal: research consortium for x-ray topography on line X-19 at NSLS.** Bilello, J.C. (State Univ. of New York, Stony Brook (USA). Dept. of Materials Science and Engineering). 1 Nov 1983. Contract AC02-80ER10740. 13p. NTIS, PC A02/MF A01. Order Number DE84004212.

The basic design phase of the Synchrotron Topographic Project has been completed and a description of this work has been reported by Bilello et al. Construction of several major components of the Synchrotron Topography Station (STS) has already been completed and installed at the facility. The experimental hutch, control room, and portable darkroom chamber have been completed. Assembly of the computer hardware components, including a PDP 11/23, printer, mag-tape down loader/backup system and motor controller assembly has been completed. Work is continuing on hardware for interfacing, and on software development for interactively controlling, the 13 motors which will automate the experimental facility. The White Beam Camera, film-plate dispenser, Real-time TV alignment camera, and motorized lift table assembly are completed. These components are shown as -installed at STS. Finally a number of other major pieces of apparatus are finished, but await completion of services (electric power, water, drains etc.) to the hutch and suitable operation of the x-ray ring to make alignment possible, before installation at NSLS. Research work has focussed on problems of x-ray optics and on developing new techniques for applying topography to problems in materials science.

8057 **(DOE/ER/10866—T1) Optical properties of potassium hollandite.** (Northeastern Univ., Boston, MA (USA)). [nd]. Contract AC02-81ER10866. 4p. NTIS, PC A02/MF A01. Order Number DE84004363.

In order to interpret optical data on potassium hollandite, the infrared absorption and Raman scattering cross sections have been calculated using the Beyeler's model for the mobile potassium ions in this compound.

8058 (INIS-BR—86, pp 200) **Thermoluminescent properties of Brazilian topaz.** Lima, C.A.F.; Rosa, L.A.R. da; Cunha, P.G. da (Instituto de Radioprotecao e Dosimetria, Rio de Janeiro (Brazil)). 1983. NTIS (US Sales Only), PC A15/MF A01. (CONF-830396—).

From Meeting on radiological protection and dosimetry; Itaipava, Brazil (21 Mar 1983).

Published in summary form only.

8059 (INIS-BR—86, pp 201-203) **Lyoluminescent dosimetry with saccharides.** Hazin, C.A.; Khoury, H.J.; Villar, H.P. (Pernambuco Univ., Recife (Brazil). Dept. de Energia Nuclear). 1983. NTIS (US Sales Only), PC A15/MF A01. (CONF-830396—).

From Meeting on radiological protection and dosimetry; Itaipava, Brazil (21 Mar 1983).

The response of several saccharides submitted to the radiation from a ^{60}Co source was studied.

8060 **(INIS-mf—8291) New halides of neodymium and their crystal structures.** Loechner, U. (Karlsruhe Univ. (T.H.) (Germany, F.R.). Fakultaet fuer Chemie). 12 Dec 1980. 129p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE84700202.

The crystal structures of the peritectic phases NdClsub(2.27) (t-phase) and NdClsub(2.37) (rh-phase) were determined. The structure of the rh-phase was solved, from the t-phase only the elementary cell could be determined because no single crystals of sufficient quality were obtained. Jutting out feature of the rh-phase which has to be formulated as $Nd_{14}Cl_{32}O$ is a polyeder cluster of 6 quadratic antiprisms the inner cubo octahedric cavity of which is occupied by an oxygen atom. The linkage of these polyeder cluster ensues only under each other along the triple axis of the rhomboedric system over 3 upper and 3 lower common borders each. Therewith for the first time a superlattice of the fluorite-type was found in which this unit exclusively occurs. The type of linkage of polyeder clusters causes the occurrence of an exceptional polyeder around the twovalent Nd ions which can be looked at as a zwitter polyeder of icosahedron and cube and therefore coordinates tenfold the twovalent neodymium. The strict order of chemically and crystallografically clearly differentiated cations is expressed by a hexagonal-rhomboedric superstructure of the fluorite-aristotyp with a doubled c-axis. The phase diagram of the system Nd-$NdBr_3$ was determined and a structure proposition was worked out for the first Vernier phase in there with n=4 of the series Lnsub(n)Xsub(2n+1).

8061 (INIS-mf—8664, pp 28) **Fabrication of Pbsub(1-x)Snsub(x)Te-PbTe-multiple hetero structures by a modified Hot Wall Epitaxy equipment.** Clemens, H.; Fantner, E.J.; Bauer, G. (Montanistische Hochschule, Leoben (Austria). Inst. fuer Physik); Lopez-Otero, A. (Johannes Kepler Univ., Linz (Austria). Inst. fuer Physik). 1982. (In German). NTIS (US Sales Only), PC A05/MF A01. (CONF-8209185—).

From Annual conference of the Austrian Physical Society; Graz, Austria (22 Sep 1982).

8062 (INIS-mf—8664, pp 25) **Production of new phases in the Nb - Se system and of crystals with high percentage additions of Re, Ni, Co.** Gruber, H. (Technische Univ., Graz (Austria). Inst. fuer Festkoerperphysik); Sitte, W. (Technische Univ., Graz (Austria). Inst. fuer Physikalische und Theoretische Chemie). 1982. (In German). NTIS (US Sales Only), PC A05/MF A01. (CONF-8209185—).

From Annual conference of the Austrian Physical Society; Graz, Austria (22 Sep 1982).

8063 (INIS-mf—8664, pp 59) **Detectors for the near and intermediate infrared based on lead telluride.** Heinrich, H.; Mauer, W. (Johannes Kepler Univ., Linz (Austria). Inst. fuer Experimentalphysik). 1982. (In German). NTIS (US Sales Only), PC A05/MF A01. (CONF-8209185—).

From Annual conference of the Austrian Physical Society; Graz, Austria (22 Sep 1982).

8064 (INIS-mf—8664, pp 27) **Infrared luminiscence and optical non-linearity in PbTe.** Kaufmann, B.; Nicholas, R.J.; Bauer, G. (Montanistische Hochschule, Leoben (Austria). Inst. fuer Physik). 1982. (In German). NTIS (US Sales Only), PC A05/MF A01. (CONF-8209185—).

From Annual conference of the Austrian Physical Society; Graz, Austria (22 Sep 1982).

8065 (INIS-mf—8664, pp 36) **Bound additivity applied to piezoelectricity: piezo constants of Lanthanumbititanate.** Krempl, P.; Engel, G. (AVL GmbH, Graz (Austria)). 1982. (In German). NTIS (US Sales Only), PC A05/MF A01. (CONF-8209185—).

From Annual conference of the Austrian Physical Society; Graz, Austria (22 Sep 1982).

8066 (INIS-mf—8664, pp 24) **Nuclear transmutation doping of gallium phosphide.** Huber, A. (Vienna Univ. (Austria). Inst. fuer Festkoerperphysik); Kuchar, F. (Ludwig Boltzmann-Institut fuer Nuklearmedizin, Vienna (Austria)); Casta, J. (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H. ASTRA-Reaktorinstitut). 1982. (In German). NTIS (US Sales Only), PC A05/MF A01. (CONF-8209185—).

From Annual conference of the Austrian Physical Society; Graz, Austria (22 Sep 1982).

8067 **(LBL—16774) High resolution study of the relationship between misfit accommodation and growth of Cu/sub 2-x/ in CdS.** Sands, T.; Washburn, J.; Gronsky, R. (Lawrence Berkeley Lab., CA (USA)). Oct 1983. Contract AC03-76SF00098. 14p. (CONF-831174—52). NTIS, PC A02/MF A01. Order Number DE84004636.

From Materials Research Society annual meeting; Boston, MA, USA (14 Nov 1983).

The growth of Cu/sub 2-x/ in the (0001) basal face of single crystal cadmium sulfide has been studied with high resolution transmission electron microscopy (HRTEM) and diffraction. Cross-sectional Cu/sub 2-x/S/CdS specimens and plan-view Cu/sub 2-x/S separated films were prepared from heterojunctions formed by the aqueous conversion of CdS to topotaxial Cu/sub 2-x/S. Low chalcocite films were found to form in two principal stages: (1) coalescence of low chalcocite islands; and (2) an accelerated reaction localized at pores in the Cu/sub 2-x/S film. Several possible misfit accommodation mechanisms involving twinning, cracking, and a second copper sulfide phase were identified.

8068 **(LBL—16884) Determination of the specific site occupation of rare earth additions in $Y_{1.7}SM_{0.8}Lu_{0.7}Fe_5O_{12}$ thin films by the orientation dependence of characteristic x-ray emissions.** Krishnan, K.M.; Rez, P.; Mishra, R.; Thomas, G. (Lawrence Berkeley Lab., CA (USA)). Nov 1983. Contract AC03-76SF00098. 14p. (CONF-831174—54). NTIS, PC A02/MF A01. Order Number DE84004632.

From Materials Research Society annual meeting; Boston, MA, USA (14 Nov 1983).

The orientation dependence of characteristic x-ray emissions have been used to determine specific site occupations of Rare Earth additions in epitaxially grown films of $Y_{1.7}Sm_{0.8}Lu_{0.7}Fe_5O_{12}$. A theoretical formulation based on the assumption of highly localized inner shell excitations was used not only to predict specific site sensitive orientations, but also to refine experimentally observed data employing a constrained least squares analysis to give probabilities for the occupation of the RE additions in the different crystallographic sites. Thus, it has been shown that in this compound the preference for the RE additions is a predominantly octahedral occupa-

tion with a probability ≧ 95%. Some of the assumptions and limitations of the technique have also been discussed.

8069 **(OEFZS—4219) Conservation of mining and metallurgic arachaeologic wooden objects by impregnation and radiation curing.** Schaudy, R.; Slais, E.; Eibner, C. (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H.). May 1983. 26p. (In German). (CH—317/83). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83704105.

The conservation of mining and metallurgic archaeologic wooden objects of different grade of destruction by impregnation with radiation-curable impregnating agents followed by in-situ-curing with gamma rays is described. Dry objects have been consolidated after cautious cleaning, whereas wet findings had to be freeze dried first. The results are discussed.

8070 **(SAND—83-2540C) In situ laser measurements of silicon CVD.** Breiland, W.G.; Ho, P. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 25p. NTIS, PC A02/MF A01. Order Number DE84004148.

Portions are illegible in microfiche products.

A variety of in-situ diagnostic methods employing lasers have been used to study the fundamental chemical and physical processes that occur during the chemical vapor deposition of silicon from silane and dichlorosilane. These nonintrusive methods can detect chemical species such as reactants, products, reactive intermediates, and particulates that are present in the gas phase during CVD. These methods can also be used to measure fluid-dynamics properties such as temperature and velocity fields. It is found that gas-phase processes are an important part of chemical vapor deposition.

8071 **Resonance ionization spectroscopy measurement of vapor pressure of rubidium iodide.** Capelle, G.A.; Jessup, D.A.; Borella, H.M.; Franks, L.A. (EG and G Energy Measurements, Incorporated, Santa Barbara Operations, Goleta, California 93117). *Applied Physics Letters;* **44**: No. 2, 177-179(15 Jan 1984). Contract AC08-83NV10282.

Resonance ionization spectroscopy has been used to measure vapor pressure data for a solid (RbI) to very low pressures. A pulsed UV laser was used to dissociate RbI molecules in the vapor phase established over a sample at known temperature. The rubidium atoms were then ionized by a two-step process using a dye laser tuned to either of two allowed transitions in the ground-state atomic Rb system. These measurements have extended the RbI vapor pressure versus temperature curve approximately 10 orders of magnitude below previously reported experimental data. Although this experiment is limited to RbI, the technique is applicable to a wide variety of solids, both atomic and molecular.

8072 **Properties of amorphous silicon tin alloys produced using the radio frequency glow discharge technique.** Mahan, A.H.; Williamson, D.L.; Madan, A. (Solar Energy Research Institute, Golden, Colorado 80401). *Applied Physics Letters;* **44**: No. 2, 220-222(15 Jan 1984). Contract AC02-77CH00178.

Amorphous silicon tin films have been deposited by the glow discharge technique using SiH_4, H_2, and $SnCl_4$ or Sn $(CH_3)_4$ gas mixtures. An n to p-type conductivity transition with increasing Sn content in the films is found for both types of Sn alloying sources. Such a transition satisfactorily explains the observed dark and light conductivity behavior.

8073 **Comparison of channeling radiation from diamonds with and without platelets.** Park, H.; Pantell, R.H.; Swent, R.L.; Kephart, J.O.; Berman, B.L.; Datz, S.; Fearick, R.W. (Department of Electrical Engineering, Stanford University, Stanford, California 94305). *Journal of Applied Physics;* **55**: No. 2, 358-364(15 Jan 1984). Contract W-7405-ENG-48.

Channeling-radiation spectra produced by planar-channeled relativistic positrons and electrons in Type-Ia and Type-IIa diamonds have been measured. Because of the presence of platelets in the Type-Ia diamond, some of the spectra measured for this crystal differ markedly from their counterparts for the Type-IIa diamond. These striking differences illustrate the potential applications of channeling radiation as a diagnostic tool for studies of impurities or defects in crystals.

8074 **Residual strains in amorphous silicon films measured by x-ray double crystal topography.** Kuo, C.L.; Vanier, P.E.; Bilello, J.C. (Department of Materials Science and Engineering, State University of New York at Stony Brook, Stony Brook, New York 11794). *Journal of Applied Physics;* **55**: No. 2, 375-377(15 Jan 1984). Contract AC02-76CH00016.

A new application of double crystal topography using selected diffraction from portions of bent crystals was used to determine the curvature of single crystal Si wafers coated with hydrogenated amorphous Si (a-Si:H) films. This direct imaging method allowed measurements of the radii of curvature R of bent crystals over a range ≃0.2—1000 m. Using this procedure two different series of a-Si:H films were measured to compare the internal strains and monitor these as a function of film thickness. The curvature of the sample crystals was shown to be inversely proportional to the thickness of the film. The internal stress was found to be independent of film thickness, but only depended on the processing conditions.

8075 **Determination of trapped charge emission rates from nonexponential capacitance transients due to high trap densities in semiconductors.** Wang, A.C.; Sah, C.T. (Department of Electrical Engineering, University of Illinois, Urbana, Illinois 61801). *Journal of Applied Physics;* **55**: No. 2, 565-570(15 Jan 1984).

Simple analytical expressions are derived to determine the trapped charge emission rates from the initial or final decay of capacitance transients in a semiconductor junction containing shallow dopants and traps of arbitrary profiles, even though the whole decay is nonexponential due to high trap densities. Two special cases of density profiles are then examined. "Nonexponentiality" is quantitatively defined and simple expressions are presented. We show that charging traps in part of the depletion layer may increase or reduce nonexponentiality, depending on the trap density in the region dynamically swept through during the transient. Measurements on a gold-doped diode give good agreeement with our analysis.

8076 **Observation of Si_2 in a chemical vapor deposition reactor by laser excited fluorescence.** Ho, P.; Breiland, W.G. (Sandia National Laboratories, Division 1126, Albuquerque, New Mexico 87185). *Applied Physics Letters;* **44**: No. 1, 51-53(1 Jan 1984). Contract AC04-76DP00789.

For the first time an intermediate chemical species, Si_2, has been observed in the gas phase during the chemical vapor deposition of silicon from silane. This observation is inconsistent with previous theoretical models for silicon deposition, which assume that either thermodynamic equilibrium or surface kinetics determines the silicon deposition rate. It is consistent with the predictions of a new model for chemical vapor deposition by Coltrin et al., in which gas phase chemical kinetics play an important role in the deposition mechanism. The Si_2 molecule could be a precursor to the nucleation of silicon particulates in the gas phase.

8077 **Pulsed laser melting of amorphous silicon layers.** Narayan, J.; White, C.W. (Solid State Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831). *Applied Physics Letters;* **44**: No. 1, 35-37(1 Jan 1984). Contract W-7405-ENG-26.

We have investigated microstructural changes in self-implanted and arsenic-ion-implanted amorphous silicon layers as a function of energy density after pulsed ruby laser irradiation, using cross-section transmission electron microscopy and Rutherford backscattering. In specimens irradiated with energy densities less than that required to cause complete annealing, we have identified two distinct regions; the first one consisting of fine polycrystals and the second one consisting of large polycrystals. The changes in thickness of these two regions as a function of pulse energy density are described. Concomitant changes in arsenic concentration profiles are consistent with diffusion in liquid silicon. From the profile

broadening in the large polycrystalline region, the crystal growth velocity was estimated to be 4—6 ms^{-1}.

8078 Neutron diffraction structural study of pyroelectric $Li_2SO_4xH_2O$ at 293, 80, and 20 K. Lundgren, J.; Kvick; Karppinen, M.; Liminga, R.; Abrahams, S.C. (Chemistry Department, Brookhaven National Laboratory, Upton, New York 11973). *Journal of Chemical Physics;* **80**: No. 1, 423-430(1 Jan 1984).

Lithium sulfate monohydrate has been studied at 293, 80, and 20 K by neutron diffraction using the same ground spherical crystal. $Li_2SO_4xH_2O$ is monoclinic, space group $P2_1$, with lattice dimensions at 293 K of a = 5.450(3), b = 4.872(3), c = 8.164(4) A, β = 107.31(3)°; at 80 K: a = 5.449(2), b = 4.832(2), c = 8.141(2) A, β = 107.21(1)°; and at 20 K: a = 5.449(2), b = 4.832(2), c = 8.137(2) A, β = 107.19(1)°. There are two formula units in the unit cell. Least-squares refinement based on 1749 (293 K), 1712 (80 K), and 880 (20 K) reflections gave final R(F) values of 0.022, 0.016, and 0.014, respectively. All structure factors were corrected for thermal diffuse scattering. A Gram—Charlier expansion of the probability density function was used to describe the thermal vibrations of the water molecule which at 293 K are consistent with a previously postulated flipping motion. The O(W)xxxO(W) hydrogen bond distance is 0.091(3) A shorter and the O(W)xxxO(W)xxxO(W) angle is 3.9(1)° larger at 20 K than at 293 K: the O(W)xxxO(1) distance to a sulfate oxygen is 0.041(3) A shorter. Both kinds of hydrogen bonds are weak and bent.

8079 Local fields and infrared absorption intensities of H_2O in hydrated β-alumina. Bates, J.B.; Wang, J.C.; Dudney, N.J. (Solid State Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). *Journal of Chemical Physics;* **80**: No. 1, 123-133(1 Jan 1984).

Local electric fields were calculated in the region of the conduction layer occupied by water molecules in hydrated b-alumina, and the dipole derivatives for the H_2O normal vibrations in Li and Na/sub 0.3/Li/sub 0.7/ β-alumina were determined from the local-field-corrected absorption intensities. The local field has a significant effect on the relative magnitudes of ν_1 and ν_3. However, a calculation of the polar tensors of H_2O and Li β-alumina shows that the large intensity of ν_1 compared to the gas phase value is due to hydrogen bonding which results in a large increase in the component of the dipole moment change along the O—H bond with displacement of the proton.

8080 Thermodynamics of the lanthanide trifluorides. V. The heat capacities of dysprosium trifluoride, DyF_3, and erbium trifluoride, ErF_3, from 5 to 350 K. Flotow, H.E.; O'Hare, P.A.G. (Argonne National Laboratory, Argonne, Illinois 60439). *Journal of Chemical Physics;* **80**: No. 1, 460-466(1 Jan 1984).

The heat capacities of pure, well-characterized samples of DyF_3 and ErF_3 were measured by adiabatic calorimetry from 5 to 350 K. The heat capacities C/sup circle-open//sub p/, the entropies $S°$, the enthalpy increments $H°(T)-H°(0)$, and the Planck functions $-[G°(T)-H°(0)]/T$ are presented in tabular form at selected temperatures to 350 K. The values of the last three functions were adjusted for the removal of degeneracies associated with the magnetic ordering of DyF_3 and ErF_3 below 5 K. Also presented are recommended thermochemical functions at 298.15 K and tables of recommended high-temperature thermodynamic functions from 400 K to the melting temperatures. The excess heat capacities due to the internal electronic energy levels of Dy^{+3} in DyF_3 and of Er^{+3} in ErF_3 were calculated from calorimetric results. In the case of DyF_3, the eight Kramer's doublets derived from spectroscopic measurements were used to calculate an excess heat capacity which is in good agreement with the calorimetric data.

8081 Paramagnetic trivalent silicon centers in gamma irradiated metal-oxide-silicon structures. Lenahan, P.M.; Dressendorfer, P.V. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Applied Physics Letters;* **44**: No. 1, 96-98(1 Jan 1984). Contract AC04-76DP00789.

We find that two paramagnetic "trivalent silicon" centers appear to be primarily responsible for radiation damage in metal-oxide-silicon structures.

8082 Comment on "Lattice location of chromium in semi-insulating GaAs by ion channeling techniques". Pronko, P.P.; Bhattacharya, R.S.; Holland, O.W.; Appleton, B.R. (Universal Energy Systems, Dayton, Ohio 45432). *Applied Physics Letters;* **44**: No. 1, 150-150(1 Jan 1984).

A comment on lattice location of chromium by ion channeling and detection of x-ray signals of Cr-Kα excited by 1-MeV H^+ from a Cr-doped GaAs is presented.

8083 Electron and positron planar channeling radiation from diamond. Datz, S.; Fearick, R.W. (Oak Ridge National Lab., TN (USA)); Park, H.; Pantell, R.H.; Swent, R.L.; Kephart, J.O.; Klein, R.K. (Stanford Univ., CA (USA). Dept. of Electrical Engineering); Berman, B.L. (California Univ., Livermore (USA). Lawrence Livermore National Lab.). *Physics Letters [Section] A;* **96**: No. 6, 314-318(11 Jul 1983).

Channeling-radiation spectra have been obtained from a diamond with approx.= 54.5 MeV electrons and positrons. Theoretical calculations are found to fit the experimental results well for electrons, but significant discrepancies exist between theoretical predictions and the positron data.

8084 Method of preparing high-temperature-stable thin-film resistors. Raymond, L.S. (to Dept. of Energy). US Patent 4,391,846. 5 Jul 1983. Filed date 12 Nov 1980. vp. PAT-APPL-206409.

A chemical vapor deposition method is disclosed for manufacturing tungsten-silicide thin-film resistors of predetermined bulk resistivity and temperature coefficient of resistance (TCR). Gaseous compounds of tungsten and silicon are decomposed on a hot substrate to deposit a thin-film of tungsten-silicide. The TCR of the film is determined by the crystallinity of the grain structure, which is controlled by the temperature of deposition and the tungsten to silicon ratio. The bulk resistivity is determined by the tungsten to silicon ratio. Manipulation of the fabrication parameters allows for sensitive control of the properties of the resistor.

8085 Observation of the existence of electrically excited purely mechanical resonance in piezoelectric and ferroelectric materials. Chen, P.J. (Sandia National Labs., Albuquerque, NM (USA)). *Nuovo Cimento della Societa Italiana di Fisica, [Sezione] D: Condensed Matter, Atomic, Molecular and Chemical Physics, Biophysics;* **2**: No. 4, 1145-1155(Jul-Aug 1983). Contract AC04-76DP00789.

A displacement laser interferometer system has been adapted to measure the mechanical displacements of specimens of piezoelectric and ferroelectric materials driven by cyclic electric fields. It is found that mechanical resonances of quite large amplitudes can exist independent of any noticeable electrical disturbances. They are also detected in virgin and depoled specimens of ferroelectric ceramics. Preliminary experimental evidence suggests that this phenomenon depends on the domain structure of the ferroelectric materials.

8086 Pulsed-Raman measurements of temperature when large temperature variations and gradients are present. Wood, R.F.; Rasolt, M.; Jellison, G.E. Jr. (Oak Ridge National Lab., TN). pp 61-66 of Laser and electron-beam interactions with solids. Appleton, B.R.; Celler, G.K. (eds.). Amsterdam, Netherlands; Elsevier Science Publishing Company, Inc. (1982). Contract W-7405-ENG-26.

Pulsed Raman temperature measurements by Lo and Compaan on Si samples have been interpreted as proving that the surface region does not melt during intense pulsed laser irradiation. In this paper, it is shown by detailed calculations with the melting model that the choice of experimental parameters in the Raman measurements can severely compromise a straightforward interpretation of the data. Moreover, it is demonstrated that temperatures extracted from Raman measurements are highly sensitive to the temperature-dependent optical properties of the material. Finally, it is pointed out that the very large temperature gradients present during pulsed laser annealing may entirely invalidate the Stokes/anti-Stokes ratio as an accurate temperature probe.

8087 **Microstructure of evaporated dielectric films.** Kenik, E.A. (Oak Ridge National Lab., TN); Lowrey, W.H.; Houston, J.T. pp 580-581 of 40th annual proceedings of the Electron Microscopy Society of America. Bailey, G.W. (ed.). Washington, DC; Electron Microscopy Society of America (1982). Contract W-7405-ENG-26.

The present study is aimed at understanding the microstructural and microchemical state of several types of dielectric films and correlation of that state with the observed properties. Thin films of ZnS, ZnSe and ThF_4 prepared in either of two different fashions have been examined.

8088 **Anomalous temperature effect on the Fe^{3+} cubic crystalline field splitting in $KTaO_3$.** Rytz, D. (Swiss Federal Inst. of Tech., Lausanne); Hoechli, U.T.; Mueller, K.A.; Berlinger, W.; Boatner, L.A. *Journal of Physics C: Solid State Physics;* **15**: 3371-3379(1982).

Electron paramagnetic resonance measurements of the cubic crystalline field splitting parameter of Fe^{3+} at the Ta site in $KTaO_3$ are reported as a function of temperature, pressure, and Nb doping concentration. The relative dependence of the splitting parameter a on the unit-cell volume was found to be similar in the two incipient ferroelectrics $KTaO_3$ and $SrTiO_3$. The explicit temperatur effect, i.e., the derivative partial derivative of a with respect to T at constant volume and concentration) is negative in $KTaO_3$ (and $SrTiO_3$) whereas it is positive in MgO, a typical inert dielectric oxide. This distinction appears to be related to the driving mechanism of ferroelectricity.

8089 **Investigation of the annihilation of positrons in semiconductor compounds of GaAs, GaP and Si.** Sayed, E.M.; Abdoulmomen, M.A.; Abuoelfotouh, F. (Riyad University). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 2, 1869-1870(Apr 1981). (CONF-801111—).

From 6. conference on application of accelerators in research and industry; Denton, TX, USA (3 Nov 1980).

The positron annihilation method was applied to study the effect of the magnetic field on the correlation curves and the mean lifetime of the process of the two gamma rays annihilation. Samples of single crystals of GaAs, GaP/Te, GaP/U and Si were used.

8090 **Ion implantation in compound semiconductor research.** Streetman, B.G. (Univ. of Illinois at Urban-Champaign, Urbana, Illinois 61801). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 2, 1742-1746(Apr 1981). (CONF-801111—).

From 6. conference on application of accelerators in research and industry; Denton, TX, USA (3 Nov 1980).

Ion implantation is widely used in the fabrication of III-V compound semiconductor devices for microwave and optoelectronic applications and in high-speed integrated circuits. Other applications employ implantation as a tool for basic semiconductor research. This paper provides an overview of these applications, along with problems in the implantation and annealing of compounds and recent solutions to these problems.

8091 **Application of magnetic scanning to high current implantation.** Hanley, P.R.; Ehrlich, C.D. (Blackburn Industrial Park, Gloucester, MA 01930). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 2, 1747-1750(Apr 1981). (CONF-801111—).

From 6. conference on application of accelerators in research and industry; Denton, TX, USA (3 Nov 1980).

High current ion implantation systems employing beams of $^{75}As^+$ at 10 mA or more at energies of the order of 100 keV depend upon electron space charge neutralization to preserve the ion optical quality of the beam during transport from the source to the wafer implant location. Time varying magnetic fields have been used to deflect these beams over lateral dimensions up to 300 mm at frequencies of the order of 0.1 Hz, without affecting low energy electrons trapped in the potential well of the beam, and without significant modification of the ion beam shape. Hybrid magnetic-mechanical scanning of high current ion beams has been shown to be capable of averaging the implanted dose with uniformities as good as $2\sigma < 1\%$ across 100 mm diameter silicon wafers mounted on an 0.8 meter disc rotating in vacuum at 1000 r.p.m. The physical basis of angle corrected hybrid magnetic-mechanical scanning is analyzed leading to a calculated relationship for the deflection (X) dependent on the scanner magnetic field (Bs). This functional dependence X = f(Bs) has also been measured using the disc as a rotating beam profile monitor. From the measured dependence, implant dose uniformity across a long scan can be obtained as shown by sheet resistance maps of ion implanted wafers. The dependence of dose uniformity on the number of scans has also been evaluated, and data are presented illustrating uniformity $2\sigma < 2\%$ can be achieved using a single scan across the wafer.

8092 **Pulsed electron beam annealing ion implanted materials: Equipment and results.** Little, R.G.; Greenwald, A.C. (Spire Corp., Bedford, MA 01730). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 2, 1751-1753(Apr 1981). (CONF-801111—).

From 6. conference on application of accelerators in research and industry; Denton, TX, USA (3 Nov 1980).

A series of pulsed electron beam accelerators has been developed for the modification of material surfaces. Each facility produces an electron beam with an average particle energy of 10-100 keV, a fluence of 0.5 to 10 J/cm^2 on the sample, and a pulse width of 20-200 nsec. The total energy stored (per pulse) varies between the different models from 15 to 1500J with a maximum repetition rate of 0.5 Hz. The uniform beam has a diameter of 1-10 cm. These accelerators are used for annealing ion implants. After processing, the surface exhibits perfect, dislocation-free crystal regrowth for single crystal materials. A variety of discrete electronic devices have been fabricated with characteristics comparable to those observed with optimum thermal (furnace) annealing procedures. The first production application of pulsed electron beam annealing will be for solar cell junction fabrication, where the high speed (1800 four-inch-diameter wafers per hour) and low power consumption give a strong cost advantage over competing furnace or pulsed laser equipment.

8093 **Laser processing of ion implanted semiconductor materials for device applications.** Wilson, S.; Paulson, W.; Varker, C. (Semiconductor Research and Development Laboratories, Phoenix, Arizona). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 2, 1754-1758(Apr 1981). (CONF-801111—).

From 6. conference on application of accelerators in research and industry; Denton, TX, USA (3 Nov 1980).

Both pulsed and CW lasers have been used to anneal ion implanted single crystal silicon, polysilicon and ion implanted devices. The advantages and limitations of each type of laser and laser processing in general is discussed. Our results and those in the literature are compared to conventional thermal anneals. The thermal stability of ion-implanted, laser-annealed, single crystal silicon and polysilicon is reported.

8094 **Recrystallization of ion implanted amorphous and heavily damaged semiconductors.** Sigmon, T.W. (Stanford Electronic Laboratories, Stanford, CA 94305). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 2, 1767-1770(Apr 1981). (CONF-801111—).

From 6. conference on application of accelerators in research and industry; Denton, TX, USA (3 Nov 1980).

The use of energetic ion beams to modify the physical and electrical properties of materials has become widely adapted in the last decade. Ion implantation doping of semiconductors, such as silicon and gallium arsenide, has become accepted as a standard industrial process for device fabrication in these materials. Since an energetic ion can create lattice defects in a crystalline material, the understanding of both the removal or intentional stabilization of this lattice damage is an area of significant importance. In this paper the authors review the present understanding of the removal of high dose implant damage in semiconductor materials.

40 CHEMISTRY

REFER ALSO TO CITATION(S) 7474

4001 Analytical And Separations Chemistry

REFER ALSO TO CITATION(S) 7119, 7126, 7256, 7303, 7315, 7586, 7798, 8177, 8202, 8206, 8206, 8206, 8479

8095 **(CEA-CONF—6559) Problems encountered when integrating peaks obtained in gas chromatography. Application to the determination of hydrogen isotopes.** Beau, G. (CEA Centre d'Etudes de Valduc, 21 - Is-sur-Tille (France)). Oct 1982. 13p. (In French). (CONF-8210183—1). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704094.

From CETAMA meeting on gas phase chromatography; Fontenay-aux-Roses, France (21 Oct 1982).

The gas chromatography of hydrogen isotopes, in use for twelve years, is easy to adapt to gloves boxes. The long holding times lead to an analysis duration of around 30 minutes. This is why we have low resolution mass spectrometers. These appliances quickly respond to analytical requirements and enable an isotope processing installation to be controlled in real time. On the occasion of the use of this new analytical method, the effect of the integrators employed in chromatography on the accuracy of the results was noticed. The integrator does not solve all chromatography problems; the chromatograph-integrator must be considered as a whole. In particular what kind of integrator should be chosen in the presence of badly separated and dissymmetrical peaks. This is the question that must be posed and for which this study provides an answer.

8096 **(CEA-N—2325) Determination of plutonium, americium and curium in the marine environment.** Grenaut, CLaude; Germain, Pierre; Miramand, Pierre. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Inst. de Protection et de Surete Nucleaire). Jan 1982. 26p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83704095.

The method used in the Laboratory for plutonium, americium and curium determination in marine samples (water, sediments, animals, plants) is presented. It is a modification of a procedure based on adsorption on ion exchange resins developed by other authors. The preliminary preparation of the samples, the radiochemical procedures and electrodeposition are described so as to be used as a practical handbook.

8097 **(CEA-N—2347) Determination of technetium 99 in sea water.** Patti, F.; Garcet, M.; Jeanmaire, L. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France)). Apr 1983. 12p. (In French). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750241.

This determination of techetium is based mainly on ion exchange on an anionic resin; technetium is pre-concentrated on one column and purified in a second column. Measurement is carried out by β counting. Chemical yields on 25 and 40 l reached 87%. The concentrations observed in samples collected in the Channel, at GOURY, ranged between 0.1 and 0.5 $pCi.l^{-1}$ (from 3.7 to 18.5 $mBq.l^{-1}$). The sensitivity limit is about 0.04 $pCi.l^{-1}$ (1.48 $mBq.l^{-1}$) when operating on 25 l of sea water.

8098 **(CEA-R—5207) Non destructive testing of uranium in solution using a portable optical fiber photometer.** Boisde, Gilbert; Guillot, Philippe; Monier, Jean; Perez, J.J. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France)). 1983. 130p. (In French). NTIS (US Sales Only), PC A07/MF A01. Order Number DE83704192.

The portable instrument, called TELEPHOT 3 N, has the following main characteristics: regulated light source, optical fibers used as a light vector, an optical probe fitted with a mirror immersed in the solution, optical system with interference filters to balance the three measurement channels, analog and digital absorbance measurement electronics, and associated microcomputer for automatic data acquisition and processing. The parameters and computer programs were determined by a series of measurements taken on reference solutions covering the target ranges. A mathematical model showing uranium complexes in solution leads to the solution of second degree equation. A first degree equation is sufficient for low acidities. This unit (hardware and programs) has been qualified on different uranyl nitrate solutions subject to nuclear materials control. The small minimum quantities of product required, about 25 ml, and the short response time of around 1 minute, make it a highly practical instrument for check measurements during inspection proceedings. Similar remote measurements is planned during inspection for the glove box control of plutonium solutions. This spectrophotometry technique can be adapted for the process control of industrial solutions.

8099 **(CONF-830808—14) Extraction of ethanol from water with liquid propylene.** Victor, J.G. (Institute of Gas Technology, Chicago, IL (USA)). 1983. 6p. Institute of Gas Technology, 3424 South State Street, IIT Center, Chicago, IL 60616.

From International solvent extraction conference; Denver, CO, USA (26 Aug 1983).

To separate EtOH from water by distillation requires 40 to 50 times the minimum Gibbs free energy of mixing. Also, EtOH forms an azeotrope with water, limiting the EtOH purity to 92%. These considerations have prompted investigations of solvent extraction. This paper describes the use of liquid propylene as solvent. The process application is also described. (DLC)

8100 **(CRN-CPR—82-06) Activation analysis application to vanadium concentration in crude oils, in commercial petroleum derivatives, in natural water and in aerosols.** Lopez Munoz, B.E. (Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires; Strasbourg-1 Univ., 67 (France)). 1983. 96p. (In French). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84750228.

Portions are illegible in microfiche products.

Instrumental neutron activation analysis has been applied to the determination of V concentrations in crude oils, in commercial petroleum derivatives and in aerosols. For 1 min. irradiations in a thermal neutron flux of $10^{12} n.cm^{-2}s^{-1}$ and measurements performed with a Ge(Li) well detector, the detection limit is $2x10^{-3}$ ppm. The determination of inorganic V concentration in natural water after preconcentration by ions exchangers is obtained with a detection limit equal to 10^{-4} ppm.

8101 **(DOE/EV/10404—7) Optimization of a flow injection analysis system for multiple solvent extraction.** Roesi, T.M.; Shelly, D.C.; Warner, I.M. (Texas A and M Univ., College Station (USA). Dept. of Chemistry). 1982. Contract AS05-80EV10404. 34p. NTIS, PC A03/MF A01. Order Number DE84004117.

The performance of a multi-stage flow injection analysis solvent extraction system has been optimized. The effect of solvent segmentation devices, extraction coils and phase separators on performance characteristics is discussed. Theoretical consideration is given to the effects and determination of dispersion and the extraction dynamics within both glass and teflon extraction coils. The optimized system has a sample recovery similar to an identical manual procedure and a 1.5% relative standard deviation between injections. Sample throughput time is under 5 minutes. These characteristics represent significant improvements over the performance of the same system before optimization.

8102 **(GJ/TMC—07(83)) Procedures for field chemical analyses of water samples.** Korte, N.; Ealey, D. (Bendix Field Engineering Corp., Grand Junction, CO (USA)). Dec 1983. Contract AC13-76GJ01664. 60p. NTIS, PC A04/MF A01. Order Number DE84004369.

A successful water-quality monitoring program requires a clear understanding of appropriate measurement procedures in order to obtain reliable field data. It is imperative that the responsible personnel have a thorough knowledge of the limitations of the techniques being used. Unfortunately, there is a belief that field analyses are simple and straightforward. Yet, significant controversy as well as misuse of common measurement techniques abounds.

This document describes procedures for field measurements of pH, carbonate and bicarbonate, specific conductance, dissolved oxygen, nitrate, Eh, and uranium. Each procedure section includes an extensive discussion regarding the limitations of the method as well as brief discussions of calibration procedures and available equipment. A key feature of these procedures is the consideration given to the ultimate use of the data. For example, if the data are to be used for geochemical modeling, more precautions are needed. In contrast, routine monitoring conducted merely to recognize gross changes can be accomplished with less effort. Finally, quality assurance documentation for each measurement is addressed in detail. Particular attention is given to recording sufficient information such that decisions concerning the quality of the data can be easily made. Application of the procedures and recommendations presented in this document should result in a uniform and credible water-quality monitoring program. 22 references, 4 figures, 3 tables.

8103 (INIS-BR—86, pp 257-258) **Leachability of ^{226}Ra and ^{210}Pb from botton sediments by river waters from the Pocos de Caldas region and by saline solutions.** Oliveira, A.E. de; Franca, E.P. (Rio de Janeiro Univ. (Brazil). Inst. de Biofisica). 1983. NTIS (US Sales Only), PC A15/MF A01. (CONF-830396—).

From Meeting on radiological protection and dosimetry; Itaipava, Brazil (21 Mar 1983).

River bottom sediment samples collected in eight points of Rio das Antas and Rio Verde basins were contamined with ^{226}Ra or ^{210}Pb in the laboratory, and leached by distilled and river water or solutions of inorganic salts which should be presented in the final tailing pond effluent (Na_2SO_4, $MgSO_4$, $CaSO_4$, $BaCl_2$ and NaF).

8104 (INIS-BR—86, pp 275) **Determination of ^{226}Ra in liquid effluents with liquid scintillation counting.** Hespanhol, E.C.B.; Sachett, I.A. (Instituto de Radioprotecao e Dosimetria, Rio de Janeiro (Brazil)); Nobrega, A.W. (Instituto Oswaldo Cruz, Rio de Janeiro (Brazil)). 1983. NTIS (US Sales Only), PC A15/MF A01. (CONF-830396—).

From Meeting on radiological protection and dosimetry; Itaipava, Brazil (21 Mar 1983).

Published in summary form only.

8105 (INIS-BR—86, pp 276) **Determination of uranium isotopes by chemical stripping and α-spectrometry.** Sachett, I.A.; Nobrega, A.W.; Costa Lauria, D. da (Instituto de Radioprotecao e Dosimetria, Rio de Janeiro (Brazil)). 1983. NTIS (US Sales Only), PC A15/MF A01. (CONF-830396—).

From Meeting on radiological protection and dosimetry; Itaipava, Brazil (21 Mar 1983).

Published in summary form only.

8106 (INIS-BR—86, pp 277-278) **Thorium concentration of natural water in Al_2O_3 columns.** Sales, H.B.; Medeiros, J.A. (Instituto de Radioprotecao e Dosimetria, Rio de Janeiro (Brazil)). 1983. NTIS (US Sales Only), PC A15/MF A01. (CONF-830396—).

From Meeting on radiological protection and dosimetry; Itaipava, Brazil (21 Mar 1983).

Published in summary form only.

8107 (INIS-BR—86, pp 279-280) **Determination of uranium and thorium in river water using induced fission track technique.** Cunha, R.P.; Medeiros, J.A. (Instituto de Radioprotecao e Dosimetria, Rio de Janeiro (Brazil)). 1983. NTIS (US Sales Only), PC A15/MF A01. (CONF-830396—).

From Meeting on radiological protection and dosimetry; Itaipava, Brazil (21 Mar 1983).

Published in summary form only.

8108 (INIS-BR—86, pp 281-282) **Development of an analytical method for the determination of U-238, U-234, Th-232, Th-230, Th-228, Ra-228, Ra-226, Pb-210 and Po-210 and its application to environmental samples.** Godoy, J.M. de (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.)). 1983. NTIS (US Sales Only), PC A15/MF A01. (CONF-830396—).

From Meeting on radiological protection and dosimetry; Itaipava, Brazil (21 Mar 1983).

A method of analysis was developed for U-238, U-234, Th-232, Th-230, Th-228, Ra-228, Ra-226, Pb-210 and Po-210 starting from a same sample-solution. The chemical separation U/Th/Pb/Po/Ra was based on chromatographic extraction. (E.G.).

8109 (INIS-BR—86, pp 283-284) **Determination of thorium in ores or concentrates by spectrophotometry after ion exchange separation.** Roldao, L.A.; Duarte, L.T.; Ferreira, A.C.M.; Medeiros, J.A. (Instituto de Radioprotecao e Dosimetria, Rio de Janeiro (Brazil)). 1983. NTIS (US Sales Only), PC A15/MF A01. (CONF-830396—).

From Meeting on radiological protection and dosimetry; Itaipava, Brazil (21 Mar 1983).

Separation of Th in anionic exchange resins (Dowex-1) is favoured using methanol solutions of HNO_3, and has been used as batch process in rock analysis. This procedure was modified and studied to determine Th in a wide range of Brazilian ores and concentrates. (E.G.).

8110 (INIS-BR—86, pp 287-288) **Determination of cumulative fission product yields of several lanthanides and yttrium nuclides in the U-238 by fission neutron spectra.** Nicoli, I.G. (Instituto de Radioprotecao e Dosimetria, Rio de Janeiro (Brazil)); Postigo, A.V.B. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1983. NTIS (US Sales Only), PC A15/MF A01. (CONF-830396—).

From Meeting on radiological protection and dosimetry; Itaipava, Brazil (21 Mar 1983).

A radiochemical investigation was performed to measure the cumulative fission product yields of several lantanides and yttrium nuclides in the U-238 by fission neutron spectra. (E.G.).

8111 (INIS-BR—86, pp 285-286) **Determination of Ra-228 by measurement of the Cerenkov radiation of Ac-228.** Godoy, J.M. de (Instituto de Radioprotecao e Dosimetria, Rio de Janeiro (Brazil)); Schuettelkopf, H. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.)). 1983. NTIS (US Sales Only), PC A15/MF A01. (CONF-830396—).

From Meeting on radiological protection and dosimetry; Itaipava, Brazil (21 Mar 1983).

A determination of Ra-228 by measurement of the Cerenkov radiation of Ac-228 is done. For the determination of Ra-228 and Ra-224, respectively, the classical $BaSO_4$ precipitation method is used. In case of Ra-224 to be measured, the sample is measured immediately and again at the end of the one week. The measured values for Ra-228 in soil and plant show good agreement with the measured values obtained with other methods. (E.G.).

8112 (INIS-BR—89) **Calibration of PIXE-SP system of elementary analysis.** Tabacniks, M.H. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Apr 1983. 114 p.p. (In Portuguese). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84700205.

The set-up and calibration of the PIXE-SP System of Elementary Analysis located at the Institute of Physics of the University of Sao Paulo is described. The PIXE-SP, that operates with 8 MeV alpha beam, has been calibrated for elements with $Z >= 11$, by means of homemade evaporated standard targets of Al, Si, $BaCl_2$, K_2CrO_4, Ti, Cr, Mn, Fe, Cu, Ge, Ag, Sn, and Au. Those targets are thin, homogeneous, and have been calbrated on a microbalance within an average precision of 6%. The overall precision of the PIXE-SP System is estimated in 10% for elements with $16 <= Z < 30$, going up to 30% for the others. The detection limit of a blank Kimfol target 220 $\mu g/cm^2$ thick, irradiated with a 10 μC electric charge, shows a minimum of about 0,1 ng (approximated 4 ppm) for Mn. The PIXE-SP System has also been intercalibrated with the PIXE located at University of Gent, Belgium, by means of 12 atmospheric aerosol targets collected on two Batelle Cascade Impactors. The analyzed masses of elements with $16 <= Z < 30$ agree within 20%. (Author).

8113 (INIS-mf—8299, pp 55-56) **Investigations at the proton microprobe.** Li, M.Q. (Academia Sinica, Shanghai (China). Inst. of Nuclear Research); Mandel, A.; Pelte, D.; Traxel, K. (Heidelberg Univ. (Germany, F.R.). Physikalisches Inst.); Ender, C.; Martin, B.; Povh, B. 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

In addition to the mineralogical investigations which are described in more detail in the Kosmophysik part of this report, biological work on pollen tubes of "Lilium Longiflorum" was done. The elemental distribution in the tip of pollen tubes seems to confirm early investigations from Shanghai, where a correlation between Zn and mRNA was found. Changes in the secondary electron-imaging system led to a high stability against sparking, and an enlarge maximum scan region of 250 x 250 m^2. First investigations concerning the Z (ordinal number) contrast showed that the conditions are similar to those of the electron microprobe. The programming of the PDP 11 computer using the RSX-11M-V4,0 system is nearly finished and has already been in use. The programming is interactive. Therefore control of the experiment and comparison with former results can be done at any time during the run.

8114 (INIS-mf—8642) **Abstracts of conference on instrumental activation analysis - IAA 83.** Vobecky, M.; Obrusnik, I. (eds.). (Ceskoslovenska Komise pro Atomovou Energii, Prague). May 1983. 53p. (In Czech and Slovak). (CONF-8305140—Absts.). NTIS (US Sales Only), PC A04/MF A01. Order Number DE83704744.

From Conference on instrumental activation analysis - IAA 83; Klucenice, Czechoslovakia (30 May 1983).

The proceedings contain 42 abstracts of papers which were related to the following fields: the application of neutron activation analysis for monitoring environmental pollution, equipment for radiation detection, processing and evaluation of results, and preparation of standards and radiation sources for activation analysis.

8115 (INIS-mf—8642, pp 7) **Possibility of applying Van de Graaff accelerator of Institute of Nuclear Physics, Czechoslovak Academy of Sciences in analyses of materials.** Hnatowicz, V.; Jahoda, L.; Kvitek, J. (Ceskoslovenska Akademie Ved, Rez. Ustav Jaderne Fyziky). May 1983. (In Czech). NTIS (US Sales Only), PC A04/MF A01. (CONF-8305140—Absts.).

From Conference on instrumental activation analysis - IAA 83; Klucenice, Czechoslovakia (30 May 1983).

8116 (INIS-mf—8642, pp 8-9) **Multielement standard for routine INAA.** Vobecky, M.; Valasek, J. (Ceskoslovenska Akademie Ved, Prague. Ustav Nuklearni Biologie a Radiochemie). May 1983. (In Czech). NTIS (US Sales Only), PC A04/MF A01. (CONF-8305140—Absts.).

From Conference on instrumental activation analysis - IAA 83; Klucenice, Czechoslovakia (30 May 1983).

8117 (INIS-mf—8642, pp 10) **Precision and correctness of aerosol analysis by INAA.** Obrusnik, I. (Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia)). May 1983. (In Czech). NTIS (US Sales Only), PC A04/MF A01. (CONF-8305140—Absts.).

From Conference on instrumental activation analysis - IAA 83; Klucenice, Czechoslovakia (30 May 1983).

8118 (INIS-mf—8642, pp 11) **Problems and technique of sample activation in NAA using WWR-S reactor.** Posta, S.; Osmera, B.; Pittermann, P. (Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia)). May 1983. (In Czech). NTIS (US Sales Only), PC A04/MF A01. (CONF-8305140—Absts.).

From Conference on instrumental activation analysis - IAA 83; Klucenice, Czechoslovakia (30 May 1983).

8119 (INIS-mf—8642, pp 12) **Application of INAA in classifying glass from archeological findings.** Frana, J.; Mastalka, A. (Ceskoslovenska Akademie Ved, Rez. Ustav Jaderne Fyziky); Venclova, N. (Ceskoslovenska Akademie Ved, Prague. Archeologicky Ustav). May 1983. (In Czech). NTIS (US Sales Only), PC A04/MF A01. (CONF-8305140—Absts.).

From Conference on instrumental activation analysis - IAA 83; Klucenice, Czechoslovakia (30 May 1983).

8120 (INIS-mf—8642, pp 13) **Homogeneity tests of reference specimens of power plant fly ash using INAA method with short-term irradiation.** Kucera, J.; Soukal, L. (Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia)). May 1983. (In Czech). NTIS (US Sales Only), PC A04/MF A01. (CONF-8305140—Absts.).

From Conference on instrumental activation analysis - IAA 83; Klucenice, Czechoslovakia (30 May 1983).

8121 (INIS-mf—8642, pp 14) **Nondestructive neutron activation analysis of gallium arsenide.** Vobecky, M. (Ceskoslovenska Akademie Ved, Prague. Ustav Nuklearni Biologie a Radiochemie). May 1983. (In Czech). NTIS (US Sales Only), PC A04/MF A01. (CONF-8305140—Absts.).

From Conference on instrumental activation analysis - IAA 83; Klucenice, Czechoslovakia (30 May 1983).

8122 (INIS-mf—8664, pp 31) **Determination of detection limits in trace element analysis by proton-induced X-ray radiation (PIXE).** Rauscher, G.; Geretschlaeger, M.; Paul, H. (Johannes Kepler Univ., Linz (Austria)). 1982. (In German). NTIS (US Sales Only), PC A05/MF A01. (CONF-8209185—).

From Annual conference of the Austrian Physical Society; Graz, Austria (22 Sep 1982).

8123 (JAERI-M—82-051) **Committee report on the state-of-art of uranium isotope enrichment measurement techniques.** (Japan Atomic Energy Research Inst., Tokyo). Jun 1982. 104p. (In Japanese). NTIS (US Sales Only), PC A06/MF A01. Order Number DE83704096.

The activity of a sectional meeting (June, 1979 - February, 1982) for uranium enrichment measurement under the Committee on Analytical Chemistry of Nuclear Fuels and Reactor Materials is summarized. In the first part of this report, the object and present state of the measurement at the following organization are described; two development organizations (Power Reactor and Nuclear Fuel Development Corporation and Japan Nuclear Fuel Development), two nuclear fuel makers (Japan Nuclear Fuel and Mitsubishi Nuclear Fuel), one safeguards inspection organization (Nuclear Material Control Center) and one research organization (Japan Atomic Energy Research Institute). The second part contains the principle and technique of several measurement methods for uranium isotopic assay, such as mass spectrometry, passive and active assays and optical spectral method. Lastly, the concept of the reference materials and its practical information for mass spectrometry and non-destructive assay are described.

8124 (JAERI-M—82-074) **Measurements of uranium enrichment with a system of multiple single-channel analyzers.** Tojo, Takao. (Japan Atomic Energy Research Inst., Tokyo). Jul 1982. 41p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83704097.

Measurements of uranium enrichment with a system of multiple single-channel analyzers (MSCA) using a 3 in. dia. x 3 in. long NaI(Tl) crystal and standard samples of 12.318 a/o and 3.051 a/o have been made in various setting conditions of the windows of single-channel analyzers, and the results were compared with those by a Ge gamma-ray spectrometer. Differences of the enrichments by the MSCA from those by the Ge spectrometer were -0.001 a/o , 0.066 a/o and -0.009 a/o for "unknown" enrichment samples which were measured as 7.345 a/o , 5.638 a/o and 0.535 a/o. In these measurements, energy ranges of the windows were set in 165-210 keV for counting the peak count-rate of 185 keV gamma-rays from ^{235}U and in 216-291 keV for counting the background count-rate.

The measurement of the enrichment under the above condition of window setting was less affected by instability of the measuring system and by change of external gamma-rays, comparing with the other conditions tested here. Statistical standard errors of the enrichments measured as 7.3 a/o , 5.6 a/o and 0.53 a/o were 0.23 %, 0.29 % and 1.9 %, respectively, when counting time for each measurements was 10 minutes. The set of enrichment data which were obtained by iterative measurement for the 5.6 a/o sample indicated that standard deviation of the enrichment was 0.025 a/o (0.045 %).

8125 **(MLM—3115(OP)) Atomic absorption spectrophotometric methods for the determination of phosphorous and silicon in steel.** McCarthy, J.P.; Nunn, E.B.; Kinard, C. (Monsanto Research Corp., Miamisburg, OH (USA). Mound). 1983. Contract AC04-76DP00053. 7p. (CONF-831025—28). NTIS, PC A02/MF A01. Order Number DE84002826.

From 26. ORNL-DOE conference on analytical chemistry in energy technology; Knoxville, TN, USA (11 Oct 1983).

Several methods for the determination of phosphorus in steel by graphite furnace atomic absorption spectrophotometry (GFAA) have been put forth in the literature. The most promising of these procedures are evaluated and optimized parameters for this analysis are given. The methods evaluated are those involving zirconium carbide furnace tubes, chemical matrix modification with La, the use of the method of additions and calibration via NBS standards. Similarly, an overview of flame AA (FAA) methods for Si determination is given. An overall procedure is described which allows the GFAA determination of phosphorus (0.010 - 0.100%), with matrix modification using lanthanum and FAA determination of silicon (0.1 - 1%) and metal constituents in steel from a single sample dissolution using NBS steels as calibration standards.

8126 **(MLM—3127) Water analysis of glass ceramics by FT-IR spectroscopy.** Nease, A.B.; Hale, M.D.; Kramer, D.P. (Monsanto Research Corp., Miamisburg, OH (USA). Mound). 15 Dec 1983. Contract AC04-76DP00053. 21p. NTIS, PC A02/MF A01. Order Number DE84004294.

A method for measuring water concentration in glasses has been described and the results of the study of ten batches of glasses have been tabulated. It has been shown that infrared spectroscopy is a satisfactory tool for measuring water concentration in glass ceramics. The water concentrations of ten batches of glass have been shown to differ significantly, and these variances are associated with environmental humidity and glass preparation method.

8127 **(NBL—310) Preparation and provisional certification of NBL Spectrographic Impurity Standards, CRM 123 (1-7) and 124 (1-7).** Santoliquido, P.M. (Department of Energy, Argonne, IL (USA). New Brunswick Lab.). Sep 1983. 81p. NTIS, PC A05/MF A01. Order Number DE84004904.

This report describes the design, production, and provisional certification of two new certified reference materials (CRMs): CRM No. 123 (1-7), U_3O_8 containing 18 trace elements, and CRM No. 124 (1-7), U_3O_8 containing 24 trace elements. The elements to be included and concentrations to be used were decided on the basis of information gathered from users of a previous CRM of this type, CRM No. 98 (1-7). The new CRMs were prepared by the addition of trace elements to high purity U_3O_8. Provisional certification was accomplished by an interlaboratory program in which four different laboratories analyzed the materials by carrier distillation dc arc emission spectrography.

8128 **(SAND—83-1582C) Quantitative analysis of phosphosilicate glass films on silicon wafers for calibration of x-ray fluorescence spectrometry standards.** Weissman, S.H. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 11p. (CONF-830123—4). NTIS, PC A02/MF A01. Order Number DE84004069.

From International Society for Optical Engineering (SPIE) conference; Los Angeles, CA, USA (24 Jan 1983).

The phosphorus and silicon contents of phosphosilicate glass films deposited by chemical vapor deposition (CVD) on silicon wafers were determined. These films were prepared for use as x-ray fluorescence (XRF) spectrometry standards. The thin films were removed from the wafer by etching with dilute hydrofluoric acid, and the P and Si concentrations in solution were determined by inductively coupled plasma atomic emission spectroscopy (ICP). The calculated phosphorus concentration ranged from 2.2 to 12 wt %, with an uncertainty of 2.73 to 10.1 relative percent. Variation between the calculated weight loss (summation of P_2O_5 and SiO_2 amounts as determined by ICP) and the measured weight loss (determined gravimetrically) averaged 4.9%. Results from the ICP method, Fourier transform-infrared spectroscopy (FT-IR), dispersive infrared spectroscopy, electron microprobe, and x-ray fluorescence spectroscopy for the same samples are compared.

8129 **(UCRL—90102) Spectrochemical determination of tantalum in plutonium metal using direct current plasma emission spectrometry.** Fadeff, S.K.; Morris, W.F. (Lawrence Livermore National Lab., CA (USA)). 1 Dec 1983. Contract W-7405-ENG-48. 10p. (CONF-8311119—1). NTIS, PC A02/MF A01. Order Number DE84004360.

From Pu isotopic and metals exchange meeting; Miamisburg, OH, USA (2 Nov 1983).

Tantalum is determined by direct current plasma spectrometry after separation of plutonium from solution as PuF_3. After centrifugation of the PuF_3 precipitate, a low level of plutonium remains in solution in sufficient quantity to cause spectral interferences. It is necessary to determine the plutonium by dc plasma spectrometry and apply a correction to determine low tantalum concentrations with good accuracy and precision. Tantalum can be determined down to 0.4 ppM in solution with a relative standard deviation of 10 percent. Better precision can be achieved at higher concentrations. The procedure is simple and convenient for glovebox work. 5 references, 1 figure, 1 table.

8130 **Utilization of monoenergetic x-ray beams to examine the properties of radiographic intensifying screens.** Dick, C.E.; Motz, J.W. (National Bureau of Standards, Washington, DC 20234). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 2, 1554-1558(May 1983). (CONF-801111—).

From 6. conference on application of accelerators in research and industry; Denton, TX, USA (3 Nov 1980).

Monoenergetic x-ray beams, produced by the direct electron excitation of characteristic K x rays in elemental targets, are important for measuring the response of different components of radiologic imaging systems. Previous studies have investigated the energy dependence of the scatter produced as an x-ray beam traverses the object to be radiographed and the efficacy of antiscatter grids in reducing this unwanted component of the image signal. Presently, these beams are being utilized to examine the image information transfer properties of x-ray intensifying screens conventionally used in screen-film imaging systems. The technique of single photon counting is being employed to determine the relative probability distribution of the number of optical photons emitted from the screen after absorption of an incident x ray. These data can be used to determine the average number of light quanta emitted per absorbed x ray. In addition, the shape of these distributions can be used to determine the image information transfer properties of a particular screen. Results of these measurements for a typical calcium tungstate screen and one of the new rare-earth phosphor screens are presented.

8131 **Extraction behavior of molybdenum using dihexyl-N,N-diethylcarbamoylmethylphosphonate.** Baker, J.D.; Jessup, J.S.; Chow, M.L. (EG & G Idaho, Inc., Idaho Falls). *Solvent Extraction and Ion Exchange;* **1**: No. 3, 553-564(1983).

The extraction behavior of Mo from HNO_3 was studied using dihexyl-N,N-diethylcarbamoylmethylphosphonate. Distribution coefficients were measured as a function of contact time, concentration of Mo, HNO_3, NO_3^- and extractant, and extraction temperature. Above 11 M HNO_3, Mo is appreciably extracted. 3 figures, 3 tables.

8132 Facilitated transport of HNO_3 through a supported liquid membrane containing a tertiary amine as carrier. Cianetti, C.; Danesi, P.R. (Argonne National Lab., IL). *Solvent Extraction and Ion Exchange;* 1: No. 3, 565-583(1983). Contract W-31-109-ENG-38.

The facilitated transport of HNO_3 through a supported liquid membrane consisting of a porous polypropylene film containing a solution of trilaurylamine in diethylbenzene as carrier was studied as a function of the stirring speed of the aqueous solutions and the membrane composition. A physico-chemical model which takes into account diffusion through an aqueous boundary layer, a fast interfacial chemical reaction leading to the formation of a membrane soluble alkylammonium salt and diffusion through the membrane was proposed. In this way, equations were derived which describe how composition changes, occurring in the course of the permeation process, influence the membrane permeability. The experimental data were quantitatively explained by the derived equations. The results indicate that the monomeric form of the trilaurylammonium nitrate salt is the species which is mainly responsible for the acid transport through the membrane. The diffusion coefficient of the permeating species and the order of magnitude of the thickness of the aqueous boundary layer were evaluated. 8 figures.

8133 Synergistic extraction of Am(III), Cm(III), and Eu(III) by mixtures of thenoyltrifluoroacetone and a linear polyether. Ensor, D.D. (Tennessee Technological Univ., Cookeville); Shah, A.H. *Solvent Extraction and Ion Exchange;* 1: No. 2, 241-250(1983). Contract AS05-79ER10489;W-7405-ENG-26.

The linear polyether, 1, 13-bis-[8-quinolyl]-1,4,7,10,13-pentaoxatridecane (K-5), has been shown to enhance the extraction of americium [Am(III)], curium [Cm(III)], and europium [Eu(III)] by thenoyltrifluoracetone (hTTA). The extraction of the trivalent metals from an aqueous acetate buffer system (pH = 4.8) into HTTA/chloroform at 25°C was studied as a function of the concentration of K-5 in the organic phase. The synergistic specie was determined to be $M(TTA)_3$ K-5 and organic phase stability constants for the formation of this complex were evaluated. The results of this study indicate that K-5 has the ability to show some size selectivity for the trivalent metal ion. 3 figures, 3 tables.

8134 Acid extraction by supported liquid membranes containing basic carriers. Danesi, P.R.; Cianetti, C.; Horwitz, E.P. (Argonne National Lab., IL). *Solvent Extraction and Ion Exchange;* 1: No. 2, 299-309(1983). Contract W-31-109-ENG-38.

The extraction of HNO_3 (nitric acid) from aqueous solutions by permeation through a number of supported liquid membranes containing basic carriers dissolved in diethylbenzene has been studied. The results have shown that the best permeations are obtained with long chain aliphatic amines (TLA, Primene JM-T) followed by TOPO (trioctylphosphine oxide) and then by other monofunctional and bifunctional organophosphorous basic carriers. The influence of an aliphatic diluent on the permeability of HNO_3 through a supported liquid membrane containing TLA as carrier was also investigated. In this case the permeability to HNO_3 decreases as a result of the lower diffusion coefficient of the acid-carrier complex in the more vicous aliphatic solvent. 4 figures.

8135 Analytical applications of quaternary ammonium halides using ion-selective electrodes: a review. Selig, W. (Lawrence Livermore National Lab., CA). *Fresnius' Zeitschrift fuer Analytische Chemie;* 312: 419-427(1982). Contract W-7405-ENG-48.

The analytical applications of quaternary ammonium halides are reviewed. These compounds are used as titrants in the potentiometric determination of a variety of inorganic and organic anions including soaps and surfactants. Various liquid-membrane electrodes such as the perchlorate, fluoroborate, nitrate, and calcium electrodes may be used as sensors and, in some cases, solid-state electrodes such as the cyanide (iodide) electrode. The most important titrants are cetyltrimethylammonium bromide and chloride and cetylpyridinium chloride. 5 figures, 12 tables.

8136 Effect of surface layers on thin foil standards on the accuracy of quantitative E.D.S. analysis. Brown, J.M.; Fraser, H.L. (Univ. of Illinois, Urbana). pp 484-485 of 40th annual proceedings of the Electron Microscopy Society of America. Bailey, G.W. (ed.). Washington, DC; Electron Microscopy Society of America (1982). Contract AC02-76ER01198.

A study of the quantitative analysis of thin foils of δ-NiMo and β-NiAl has recently been undertaken using both the standardless technique and analysis with pure elemental standards. In the present work attempts have been made to remove the oxygen containing layer by argon ion sputtering while monitoring the oxygen signal in an Auger Electron Spectrometer. Use of such sputtered Al foils as standards did indeed show a relatively smaller x-ray yield for a given irradiated volume, but it was still higher than using the powder sample. Apparently, the Al had acquired an oxide film on exposure to the air. To further establish whether the oxide film developed with time of exposure, the x-ray analysis was repeated after the foil had been left in air for 150 hours and indeed the apparent x-ray yield had increased by 10%.

8137 (DP-tr—51-A) Theory of countercurrent extraction. IV. Extreme value formulas for countercurrent extraction variables and process design. Guangxian, X.; Biaoguo, L.; Yaming, N. Translated from *Xiyou Jinshu ;* 1: No. 1, 10-19(1982). Contract AC09-76SR00001. 16p. NTIS, PC A02/MF A01. Order Number DE84003038. DE84003038

Portions are illegible in microfiche products.

This paper proposes extreme value formulas and formulas for the optimal extraction and stripping quantities which must satisfy countercurrent process variables in constant mixed extraction ratio systems (mainly saponified acid extractant systems) and on this basis, proposes a method for calculating a set of extraction process variables. It is simpler and more convenient than methods proposed in earlier papers (it can be applied to various solvent and process stream compositions).

8138 A compilation of fast neutron interactions, cross sections, gamma spectra and gamma decay energies. McKlveen, J.W. (College of Engineering and Applied Sciences, Arizona State University, Tempe, Arizona 85281). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-28: No. 2, 1632-1634(Apr 1981). (CONF-801111—).

From 6. conference on application of accelerators in research and industry; Denton, TX, USA (3 Nov 1980).

Fast neutron activation analysis (FNAA) is an excellent nondestructive assay technique for selected nuclides such as Al, Cu, F, N, O, P, and Si and may be used to identify other trace elements such as Ag, Ba, Ca, Cd, Fe, Ga, Mg, Nd, Pd, Rb, Se, Sr, Th, U, Zn, and Zr when other, more sensitive methods are not available or whenever interference reactions render the preferred method useless. FNAA has considerable potential for increased usage in undergraduate and graduate educational experiments, industrial applications and a variety of research pursuits. However, multiple trace element identification is often difficult because there is a dearth of publications which organize and present FNAA data in a format suitable for this type of research effort. Whereas considerable amounts of general information and specific applications are described in the published literature, it is often difficult as well as tedious to consolidate the data and facts into a format suitable for general experiments or multi-element analysis. Furthermore, theoretical reactions may not be observed during experimental activation or unreported gamma radiations may impede element identification. To rectify the situation a literature survey was conducted and existing information on FNAA crossections, reactions, half-lives and decay energies was assembled for every nuclide. Then all nuclides which exist in solid form were activated for representative times and resulting gamma-ray emissions plotted to show characteristic short and long half-life decay spectra. Also, new tables were generated which show nuclides having the highest FNAA sensitivity and the preferred reaction, interference nuclides, and nuclides arranged according to decay energy. The information is now available in a book designed for laboratories interested in deciphering individual elements from unknown samples or performing multiple element analysis.

8139 **Mathematical correction of spectra with parameter drift of the energy calibration curve.** Srapenyants, R.A.; Novikov, A.I. (VIUA, Moscow). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-28: No. 2, 1669-1671(Apr 1981). (CONF-801111—).

From 6. conference on application of accelerators in research and industry; Denton, TX, USA (3 Nov 1980).

This paper describes stabilization of spectrometric arrangement in Neutron Activation Analysis (NAA) using the fast neutron generator. The proposed procedure has applications in other areas of research.

8140 **Activation analysis with 1 MeV/amu heavy ion beams.** Lass, B.D.; Schweikert, E.A. (Texas A & M University, College Station, Texas). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-28: No. 2, 1672-1674(Apr 1981). (CONF-801111—).

From 6. conference on application of accelerators in research and industry; Denton, TX, USA (3 Nov 1980).

Heavy ion beams ($Z \geq 3$) with energy of 1 MeV/amu have been used for activation analysis. The major advantage of Heavy Ion Activation Analysis (HIAA) lies in the fact that on any given target element a heavy ion beam can induce the greatest number of reactions. Some of these reactions result in radioactive products which can be measured. The increased number of reactions increases the probability of finding a reaction for a given target which is both selective and sensitive. By using low energy heavy ion beams an upper limit for elements that will activate occurs due to the Coulomb barrier between the two nuclei. It was determined experimentally that only elements $Z \leq 8$ activate. This technique is thus an excellent method for trace determination of the lowest Z elements without interferences from the matrix.

8141 **Characterization of semiconductor materials by charged particle activation.** Blondiaux, G.; Debrun, J.L.; Giovagnoli, A.; Hallais, J.; Koemmerer, C.; Valladon, M. (C.N.R.S. Service du Cyclotron, 3A, Rue de La Ferolleria, 45045 Orleans Cedex). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-28: No. 2, 1675-1678(Apr 1981). (CONF-801111—).

From 6. conference on application of accelerators in research and industry; Denton, TX, USA (3 Nov 1980).

Results obtained during the past few years by research groups working on joint projects, mainly in view of a better knowledge of GaAs, are summarized here. The procedures of radioactivation analysis with charged particles (deuterons and tritons) are described to some extent. Finally, some important aspects of charged particle activation analysis, namely: calibration, etching after irradiation and diffusion during irradiation, are discussed.

8142 **The use of accelerators for the study of delayed neutrons from fission: Significance to reactor control.** Walker, J.; Owen, J.G.; Weaver, D.R. (Univ. of Birmingham, Birmingham B15 2TT). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-28: No. 2, 1650-1653(Apr 1981). (CONF-801111—).

From 6. conference on application of accelerators in research and industry; Denton, TX, USA (3 Nov 1980).

Delayed neutrons from fission are very important in the kinetic behaviour of nuclear reactors and in the assaying of nuclear materials. Information is necessary on lifetimes, yields, and energies, and the paper shows the part which accelerators have played in providing it. Special attention is paid to yields and to recent measurements of delayed-neutron energies in fast fission; attention is drawn to gaps or uncertainties in knowledge and, therefore, to the need for new measurements.

8143 **The resolved spectroscopy using synchrotron radiation.** Walters, G.K.; Bonifield, T.D. (Rice University, Houston, Texas 77001). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* No. 2, 1220-1224(Apr 1981). (CONF-801111—).

From 6. conference on application of accelerators in research and industry; Denton, TX, USA (3 Nov 1980).

The time structure of synchrotron radiation from a single bunch of high-energy electrons circulating in a storage ring is readily exploited for studies of fast kinetic and radiative processes involving shortlived electronically-excited species in bulk matter. The sample is excited repetitively by very short bursts of monochromatized synchrotron radiation once each orbital period, as the radiation pattern associated with the radially accelerating electron bunch sweeps past an entrance aperture. Time resolved measurements of the rise and fall of features in the afterglow fluorescence spectrum are analyzed to yield rates for the formation and decay of the radiating species.

8144 **Muons, protons and heavy ions in the quantitative elucidation of the properties of diamond.** Sellschop, J.P.F. (University of the Witwatersrand, Johannesburg). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-28: No. 2, 1858-1862(Apr 1981). (CONF-801111—).

From 6. conference on application of accelerators in research and industry; Denton, TX, USA (3 Nov 1980).

In studying the physical and geochemical properties of diamond, data on both elemental composition and defect structures is required. While instrumental neutron activation analysis is an essential component of this formidable analytical task, it is incapable of providing essential data on the lightest elements. This is accessible quantitatively by the use of accelerator-produced beams of protons, helium-3, helium-4 and fluorine-19 (or nitrogen-15). The picture that emerges is that all pure diamond is - in elemental terms - characterized by no fewer than 58 impurities, of which 53 of these elements have been determined by nuclear methods, and 34 of them have been determined only by nuclear methods. If quantitative analytical data is obtained, as it should be, then a number of deductions can be made about the chemistry of the elemental impurities - such a trace element chemistry (at the ppb to ppm level !) is found to exist, which brings into focus the question of the mode of physical occurrence of these characteristic chemical impurities. Since they are not visible and appear to be fairly homogeneously distributed, a reasonable picture is to describe all diamonds (even those of the purest gem quality) as containing sub-microscopic inclusions of the parental magma in and from which the diamond crystallized.

8145 **PIXE in 1980: Summary of the second international conference on particle induced x-ray emission and its analytical applications.** Akselsson, K.R. (University of Lund, Lund). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-28: No. 2, 1370-1373(Apr 1981). (CONF-801111—).

From 6. conference on application of accelerators in research and industry; Denton, TX, USA (3 Nov 1980).

The Second International Conference on Particle Induced X-ray Emission (PIXE) and its analytical applications was held in Lund, Sweden, June 9-12, 1980. About a hundred papers were presented, including seven invited talks (PIXE and particle scattering, microbeam analysis, applications to aerosols and biological samples). The main impression left by the conference was that both the PIXE method and its applications are in a phase of fast development. Considerable effort has successfully been devoted to optimizing the basic PIXE technique. Also the great advantage of simultaneously getting information about lighter elements and sample mass was reported to have been successfully employed in routine analyses. PIXE, which was initially considered to be a method mainly for thin samples, has also been shown to be competitive for a variety of thick samples. Data from aerosol studies was presented. With the PIXE-method, it is feasible to perform series of measurements over a long period of time, many samples in parallel and/or samples from sites of poor accessibility. However, the advantages of PIXE may be further exploited in aerosol investigations and some promising lines of sampler development were reported. Sample preparation techniques are crucial for applications to biological samples and several laboratories are engaged in such developmental work. However, it was also evident that PIXE is already giving significant contributions to research in biology and medicine.

8146 **PIXE as an analytical tool: An external-beam system in helium and the role of sample preparation.** Williams, E.T.; Finston, H.L. (City University of New York, Brooklyn College, Brooklyn, New York 11210). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-28: No. 2, 1382-1385(Apr 1981). (CONF-801111—). Contract AC02-76ER03126.

From 6. conference on application of accelerators in research and industry; Denton, TX, USA (3 Nov 1980).

A PIXE system in which samples in a helium-filled target chamber are irradiated by an external proton beam is described. The system is well suited for study of a wide range of materials, some merely calling for qualitative analysis, and others requiring quantitative measurements. This variety mandates a flexible approach to sample preparation in order to obtain full sensitivity of the system. Some examples taken from our work are given.

8147 **Determination of elemental composition of river water and slime by PIXE method.** Augustyniak, S.; Jarczyk, L.; Lenczowska, J.B.; Rokita, E.; Slominska, D. (Jagellonian University, Cracow, Poland). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-28: No. 2, 1398-1400(Apr 1981). (CONF-801111—).

From 6. conference on application of accelerators in research and industry; Denton, TX, USA (3 Nov 1980).

The application of PIXE method was developed for determination of concentration of different elements in river water and bottom slime. The internal standard technique was applied for quantitative evaluation of contents of different elements. In case of river water yttrium standard was used in form of yttrium nitrate solution. The measurements for bottom slime was performed with external beam using standards with predetermined concentration of different elements. The concentration of following elements: S, Cl, K, Ca, Ti, V, Cr, Mn, Fe, Ni, Cu, Zn, Se, Br, Rb, Sr, Zr, Hg, Pb was determined with the described procedure. The estimated concentration of elements ranged from about 0.05 to about 200 ppm for water samples and from about 1.5 to about 30000 ppm in bottom slime samples.

8148 **Chemical effects in the PIXE analysis of fluorine.** Deconninck, G.; Van Den Broek, S. (Facultes Universitaires de Namur, Namur). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-28: No. 2, 1404-1406(Apr 1981). (CONF-801111—).

From 6. conference on application of accelerators in research and industry; Denton, TX, USA (3 Nov 1980).

Spectra of X-rays induced by 2 MeV ^{4}He bombardment of 24 samples of different fluorine compounds are presented. Important chemical effects are seen in the spectrum shape. The application of these effects to chemical analysis is demonstrated on samples of fluorine implanted in iron. Chemical effects are important in spectroscopy (XPS, UPS, NMR, IR, Mossbauer, ...); they are often used for the identification of the chemical species in solid. Such effects have also been observed in X-ray emission and they can be used for chemical analysis. The interest of PIXE with low energy ions is the small thickness effectively analysed (5000 A or so). Contrary to Auger and photoelectron spectroscopy, X-ray emission is not seriously affected by surface effects (contamination, plasmon, ...). In Auger, XPS and UPS applications, contamination or corrosion effects are dominant and the result of the analysis does not often reflect the real nature of the sample, but only of its surface.

8149 **Evaluation of the effectiveness of tap-water filter using in-air PIXE.** Fou, C.M. (University of Delaware, Newark, Delaware 19711). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-28: No. 2, 1407-1409(Apr 1981). (CONF-801111—).

From 6. conference on application of accelerators in research and industry; Denton, TX, USA (3 Nov 1980).

Large scale drinking water monitoring is a formidable task no matter what analysis technique is used. The commercially available tap-water filter that can be easily adapted to the faucet offers a unique possibility to collect and accumulate contaminations in the drinking water supply from a wide spread area at relatively low cost. It has been demonstrated that such filters can be examined without preparation using in-air PIXE. In the present investigation, the effectiveness of such filters is examined by comparing the water before and after filtration. This information is important if such a large scale monitoring is to be carried out. The present work also shows the merit of accumulation.

8150 **Trace metal content in aspirin and women's cosmetics via proton induced x-ray emission (PIXE).** Hichwa, B.P.; Pun, D.D.; Wang, D. (Hope College Holland, Michigan 49423). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-28: No. 2, 1410-1412(Apr 1981). (CONF-801111—).

From 6. conference on application of accelerators in research and industry; Denton, TX, USA (3 Nov 1980).

A multielemental analysis to determine the trace metal content of generic and name-brand aspirins and name-brand lipsticks was done via proton induced x-ray (PIXE) measurements. The Hope College PIXE system is described as well as the target preperation methods. The trace metal content of twelve brands of aspirin and aspirin substitutes and fourteen brands of lipstick are reported. Detection limits for most elements are in the range of 100 parts per billion (ppb) to 10 parts per million (ppm).

8151 **Proton microprobe investigation of the migration of molybdenum in graphite at high temperature.** Hanson, A.L.; Jones, K.W.; Kraner, H.W.; Shroy, R.E.; Uneberg, E. (Brookhaven National Laboratory, Upton, New York 11973). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-28: No. 2, 1421-1423(Apr 1981). (CONF-801111—). Contract AC02-76CH00016.

From 6. conference on application of accelerators in research and industry; Denton, TX, USA (3 Nov 1980).

The BNL proton microprobe has been used to study migration of molybdenum through reactor grade graphite for temperatures between 1800 and 3100°C. The proton microprobe, with a resolution between 25 and 150 micrometers, provides a unique tool for investigation of the lower temperature and shorter time heatings along with investigation of the microstructure of the system. With a high sensitivity, on the order of 1 ppm, particular attention was paid to the region governed by pore and grain boundary diffusion. The results obtained with the proton microprobe are compared with results obtained using wet chemical techniques.

8152 **Relative accuracy of k-factor calculations for thin-film x-ray analysis.** Maher, D.M. (Bell Labs., Murray Hill, NJ); Joy, D.C.; Ellington, M.B.; Zaluzec, N.J.; Mochel, P.E. pp 33-38 of Analytical electron microscopy. Geiss, R.H. (ed.). San Francisco, CA; San Francisco Press, Inc. (1981).

The results presented in this paper indicate that within the thin-film approximation and based on existing models for the Kα-line x-ray generation functions and detector energy-efficiency factors, a relative accuracy of about +-5% can be achieved when near-atomic-number elements are being analyzed; the relative accuracy becomes progressively worse as the difference in atomic number between any two analyzed elements increases.

8153 **Die tyd- en ruimtelike distribusie van temperatuur in grafietoond-atoomabsorpsiespektroskopie. (Temporal and spatial distribution of temperature in graphite furnace atomic absorption spectroscopy).** Rademeyer, C.J. Johannesburg, South Africa; Rand Afrikaans University (1980). 106p. (In Afrikaans). Registrar, Rand Afrikaans University, PO Box 524, Johannesburg, 2000.

The problem of improving the efficiency of graphite tubes used for electrothermal atomization in atomic absorption spectroscopy is approached theoretically. Two primary factors which determine this efficiency to a large extent, namely, the equilibrium temperature distribution and the temperature-time characteristics of a tube, are investigated. Use is made of two analytical models for this purpose. The equilibrium temperature distributions are calculated for 24 proposed tube designs. Based on the results of these calculations, four promising designs were selected and tubes of this shape were made for the experimental determination of their equilibrium temperature distributions. A standard graphite tube was also

incorporated in these tests. For the calculation of the temperature-time characteristics another model is proposed. The calculations of the risetime of the temperature were performed for a standard tube and for the four modified tubes mentioned above. The results were compared with experimentally determined values for each tube. Based on the calculated and experimental results found in respect of each of the two primary factors which were investigated predictions were made regarding the efficiency of the modified tube designs. These predictions were tested by determining the sensitivity obtained for cobalt, molybdenum and lead with each of the four specially made tubes and with the standard tube. The less volatile elements showed a better sensitivty (approximately three times larger) with the modified tubes than with the standard tube, in accordance with the predictions. For the more volatile lead, however, the efficiency of these tubes was lower than for the standard tube.

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REFER ALSO TO CITATION(S) 7123, 7255, 8177, 8200, 8202, 8476, 8733

8154 **(CONF-821265—1) Measurement and interpretation of plutonium spectra.** Blaise, J.; Fred, M.S.; Carnall, W.T.; Crosswhite, H.M.; Crosswhite, H. (Argonne National Lab., IL (USA); Centre National de la Recherche Scientifique, 91 - Orsay (France). Lab. Aime Cotton). 1982. Contract W-31-109-ENG-38. 28p. NTIS, PC A03/MF A01. Order Number DE84003672.

From Symposium on the chemistry of plutonium; Kansas City, MO, USA (1 Dec 1982).

The atomic spectroscopic data available for plutonium are among the rickest of any in the periodic system. They include high-resolution grating and Fourier-transform spectra as well as extensive Zeeman and isotope-shift studies. We summarize the present status of the term analysis and cite the configurations that have been identified. A least-squares adjustment of a parametric Hamiltonian for configurations of both Pu I and Pu II has shown that almost all of the expected low levels are now known. The use of a model Hamiltonian applicable to both lanthanide and actinide atomic species has been applied to the low configurations of Pu I and Pu II making use of trends predicted by ab initio calculations. This same model has been used to describe the energy levels of Pu^{3+} in $LaCl_3$, and an extension has permitted preliminary calculations of the spectra of other valence states.

8155 **(DOE/ER/02945—7) Continuous chemical reaction chromatography. Progress report, November 1, 1982-November 15, 1983.** Aris, R.; Carr, R.W. Jr. (Minnesota Univ., Minneapolis (USA). Dept. of Chemical Engineering and Materials Science). 1983. Contract AC02-76ER02945. 27p. NTIS, PC A03/MF A01. Order Number DE84004089.

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A model of a moving bed reactor has been studied in which a reversible first-order heterogeneous reaction takes place on catalyst particles passing downwards through an upcoming stream of gas. By the analysis of the transient model and the one in which the rate of adsorption is finite, insight is gained into the formation of boundary and internal discontinuities in the ideal case. The reactor behavior as described by the ideal model solution has been examined for different values of feed concentrations and reactor length. It is shown that reaction and separation can be achieved simultaneously and that the yield of the reversible reaction can be greatly improved. Indeed the configuration of the reactor and its operating conditions can be tailored so as to exceed the performance of a fixed bed both in yield and product purity. A laboratory scale countercurrent moving bed chromatographic reactor was designed and built. An experimental investigation of reactor performance is currently in progress. The reaction selected for this investigation is the catalytic hydrogenation of trimethyl benzene. The kinetics were investigated by microcatalytic reactor-gas chromatography techniques.

8156 **(LBL—16275) Density of sodium chloride solutions at high temperatures and pressures.** Phillips, S.L.; Ozbek, H.; Silvester, L.F. (Lawrence Berkeley Lab., CA (USA)). Jun 1983. Contract AC03-76SF00098. 54p. (CONF-830859—11). NTIS, PC A04/MF A01. Order Number DE84004883.

From National meeting of the American Institute of Chemical Engineers; Denver, CO, USA (28 Aug 1983).

A correlation equation is given which reproduces the density of sodium chloride solutions to +- 4% over the ranges 0 to 5 molal, 0 to 350°C and 1 to 1000 bars. Data generated from the equation are compared with selected experimental and smoothed values at typical temperatures, pressures and concentrations. Data are included for the density of sea water concentrates up to 150°C and 150 g/kg salinity at saturation vapor pressures based on a fit to a Chebyshev polynomial.

8157 **(ORNL/TM—8979) Stable isotope customer list and summary of shipments - FY 1983.** Davis, W.C. (comp.). (Oak Ridge National Lab., TN (USA)). Dec 1983. Contract W-7405-ENG-26. 31p. NTIS, PC A03/MF A01; 4. Order Number DE84003362.

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This compilation is published as an aid to those concerned with the separation and sale of stable isotopes. The information is divided into four sections: (1) alphabetical list of domestic and foreign customers, showing the stable isotopes purchased during the fiscal year; (2) alphabetical list of isotopes, cross-referenced to customer numbers and divided into domestic and foreign categories; (3) alphabetical list of states and countries, cross-referenced to customer numbers and indicating geographical concentrations of isotope users; and (4) tabulation of the shipments, quantities, and dollars for domestic, foreign, and project categories for each isotope.

8158 **(PB—83-249433) HI decomposition catalyst development studies. Final report, 1 January 1980-31 January 1981.** O'Keefe, D.R.; Norman, J.H. (General Atomic Co., San Diego, CA (USA)). Apr 1982. 48p. (GA-A—16261). NTIS, PC A03/MF A01.

This investigation was intended to demonstrate the viability of the enhanced conversion process of liquid hydrogen iodide HI(l) decomposition under anticipated process conditions. To accomplish this, an apparatus was designed, fabricated, and tested to decompose flowing HI(l) at high-temperature, high-pressure operating conditions. The catalytic systems of supported platinum and activated charcoal were studied. The platinum data correlated well with the extrapolated low-temperature data previously obtained; the activated charcoal catalyst demonstrated good activity initially but showed a cutoff in activity apparently due to iodine pore plugging. The platinum results added confidence for using the HI(l) decomposition process under anticipated engineering conditions. The high-pressure, high-temperature extreme conditions showed no innate problems. These studies enhanced the viability of the GA sulfur-iodine cycle.

8159 **Lattice theory of reaction efficiency in compartmentalized systems.** Musho, M.K.; Kozak, J.J. (Department of Chemistry and Radiation Laboratory, University of Notre Dame, Notre Dame, Indiana 46556). *Journal of Chemical Physics;* **80**: No. 1, 159-169(1 Jan 1984).

We consider the problem of reaction efficiency in compartmentalized systems. In our model, we position a target molecule (active site) at a centrosymmetric location in a reaction space defined by N-1 locations; the coordinates of these sites are specified by their positions on a d-dimensional lattice of valency ν. We then consider the factors that may influence the efficiency of an (eventual) irreversible reaction at the reaction center between a diffusing coreactant A and the target molecule B, i.e., we consider the bimolecular reaction A+B → C. We suppose there exists a biasing potential of the form v(r) = r⁻/sup s/ centered at the active site and then explore the interplay between this longer-range biasing potential and other short-range (nonspecific) chemical or cage effects in influencing the efficiency of the underlying reaction—diffusion process. These effects are studied as a function of the geometry of the compartmentalized system (i.e., its spatial extent, dimensionality

d, and valency ν), the strength of the biasing potential (values of the potential exponent s ranging from s = 1 to s = 6 are studied), the temperature and finally the role of the initial conditions. Our calculations are carried out using an approach developed recently wherein group theoretic arguments are coupled with theorems from the theory of finite Markov processes to produce exact resuls on the efficiency of reaction—diffusion processes taking place on finite, d-dimensional networks of valency ν.

8160 Two new potential energy surfaces for the F+H₂ reaction. Truhlar, D.G.; Garrett, B.C.; Blais, N.C. (Department of Chemistry, University of Minnesota, Minneapolis, Minnesota 55455). *Journal of Chemical Physics;* **80**: No. 1, 232-240(1 Jan 1984).

We have adjusted a new potential energy surface for the reaction F+H₂→FH+H and isotopic analogs such that, as compared to the widely used Muckerman no. 5 potential energy surface, rate constants and activation energies are in better agreement with experiment, and the bending potential is in better argreement with ab initio calculations, while the product vibrational energy distribution for thermal collisions is not changed greatly. The adjustments are carried out using a combination of variational transition state theory, the correlation of product vibrational energy distributions with mixed energy release as defined by Polanyi and co-workers, and quasiclassical trajectory calculations. The new surface has a classical barrier height of 0.74 kcal/mol.

8161 Dependence of reaction attributes, including differential cross sections and resonance features, on changes in the potential energy surface for the F+D₂ reaction. Walker, R.B.; Blais, N.C.; Truhlar, D.G. (Theoretical and Chemistry Divisions, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Journal of Chemical Physics;* **80**: No. 1, 246-254(1 Jan 1984).

We present a series of comparisons of dynamical reaction attributes for the reaction F+D₂→FD+D. We employ three potential energy surfaces, Muckerman surface no. 5 and two surfaces suggested more recently. These surfaces differ in barrier height and bending potential. The dynamical calculations are based on the quasiclassical trajectory method and on the bend-corrected rotating linear model. We find that new surface no. 2 does allow for significant reaction probability at 0.8 kcal/mol, as required to agree with molecular beam experiments. The wider bending potential of new surface no. 2 does not, however, have a large effect on the angular distribution. Although it is known from previous work that the barrier in the entrance channel is important for the compound-state resonance in this reaction, lowering the barrier from 1.06 kcal/mol in Muckerman surface no. 5 to 0.74 kcal/mol in the new surfaces does not make a qualitative change in the resonance features of the results. We conclude, on the basis of this paper and previous studies of the thermal rate constants, that new surface no. 2 is more accurate than the widely studied Muckerman surface no. 5 and provides a better starting point for future work.

8162 Crystal growth in aqueous solution at elevated temperatures. Barium sulfate growth kinetics. Gardner, G.L.; Nancollas, G.H. (State Univ. of New York, Buffalo). *Journal of Physical Chemistry;* **87**: No. 23, 4699-4703(10 Nov 1983).

The solubility and seeded crystallization of barium sulfate (barite) has been studied at 105 to 150°C in aqueous sodium chloride solutions at ionic strengths of 0.1 to 1.0 M. The rate of growth was proportional to the square of the supersaturation, in agreement with the results previously established at ambient temperatures. The formation of barium sulfate crystals is controlled by a surface reaction and is independent of fluid dynamics at the solid-liquid interface. Over the temperature range 25 to 125°C, the apparent activation energy for growth is 33.5 +- 4.0 kJ mol^{-1}. Added strontium ions, at concentrations similar to those found in natural brine solutions, decreased the reaction rate and lowered the apparent solubility of the grown crystalline phase. The significant decrease in the measured growth rate at 125°C in the presence of phosphonates indicates that these molecules are effective barium sulfate scale inhibitors in petroleum and geothermal brines. 5 figures, 4 tables.

8163 Synthesis and characterization of oxide interstitial derivatives of zirconium monochloride and monobromide. Seaverson, L.M.; Corbett, J.D. (Case Western Reserve Univ., Cleveland, OH). *Inorganic Chemistry;* **22**: No. 22, 3202-3210(26 Oct 1983). Contract W-7405-ENG-82.

The reactions of ZrO_2 (zirconium oxide) with double-metal-layered ZrCl (zironium chloride) and ZrBr (zirconium bromide) at ~ 980°C and with Zr metal at 930°C have been studied with the aid of high-resolution (Guinier) powder pattern data. The products of the first reaction are ZrX(O/sub y/) [XO/sub y/oxychloride or oxyobromide], an expanded ZrX structure, and Zr(O/sub x/) from solution of ZrO_2 in the metal, viz., ZrX + $nZrO_2$ = ZrX(O/sub y/) + nZr(O/sub x/). The oxygen composition of both products (y,x).varies continuously up to the point of ZrO_2 saturation where n, y, and x are respectively 0.27 (1), 0.43 (2), and 0.42 for chloride and 0.22 (2), ~ 0.35, and ~ 0.42 for bromide. Single-crystal x-ray results for ZrBrO/sub ~ 0.23/, ZrClO/sub 0.29/, and $ZrClO_{0.43}$ establish the retention of the basic ZrX structure (R anti 3 m) and the concentration of oxygen, which is distributed randomly in the distorted tetrahedral interstices between the zirconium layers. The last named composition (a = 3.4984 (2) A, c = 27.065 (4) A) is in equilibrium with ZrO_2 and gave a refined structure with R = 0.046 and R/sub w/ = 0.056 for 141 independent reflections with $2\theta \leq 59.9°$. UPS (Photoelectron spectroscopy) measurements show that the chloride oxide is still metallic.

8164 Measurement of direct current conductivity on ice samples for climatological applications. Schwander, J.; Neftel, A.; Oeschger, H.; Stauffer, B. (Univ. of Bern, Switzerland). *Journal of Physical Chemistry;* **87**: No. 21, 4157-4160(13 Oct 1983).

The electrical conductivity of natural ice samples is strongly correlated with the acidity of the melted sample and can therefore be used for climatological studies. Two physical aspects concerning this conductivity measurement have been investigated. For the used setup with unguarded electrodes it could be shown that volume conduction dominates surface conduction at -15°C. A relation between the measured conductance and the specific conductivity is established. The aging observed on stored ice samples is shown to be strongly dependent on the composition of the gas in which the ice samples are stored. Ammonia diffuses rapidly into the ice and changes its conductivity. 5 figures.

8165 Small water clusters as theoretical models for structural and kinetic properties of ice. Newton, M.D. (Brookhaven National Lab., Upton, NY). *Journal of Physical Chemistry;* **87**: No. 21, 4288-4292(13 Oct 1983).

Ab initio molecular orbital (MO) calculations have been carried out for water dimers and trimers, using a split-valence basis set supplemented with polarization functions (6 to 31*), including electron correlation for nearest-neighbor dimers via second-order Moeller-Plesset theory and a dispersion correction for next-nearest-neighbor dimers, and with corrections made for basis set superposition errors. These calculations have led to a potential energy function for cubic ice which accounts for over half of the compression of the O–O separation relative to that for the free dimer and which yields a cohesive energy close to the experimental value. A simple model for the activated complex in the migration of Bjerrum L defects in ice I, based on the concept of a bifurcated OH–O hydrogen bond in conjunction with MO calculations for appropriate water tetramers with a 6 to 31* basis set, has led to estimates of the activation energy (3.3 and 3.9 kcal/mol) falling in the lower end of the range of previous estimates (2 to 7 kcal/mol), thus indicating that the activation process requires less than the full bond energy of a single linear hydrogen bond. 1 figure, 3 tables.

8166 Porphyrin electrode films prepared by electrooxidation of metalloprotoporphyrins. Macor, K.A.; Spiro, T.G. (Princeton Univ., NJ). *Journal of the American Chemical Society;* **105**: No. 17, 5601-5607(24 Aug 1983). Contract AC02-81ER10861.

Electrooxidation in organic solvents of the dimethyl esters of several metalloprotoporphyrins (PP) (Ni/sup II/PP, Zn/sup II/PP, Co/sup II/PP, (Fe/sup III/PP)Cl, $(Fe/sup III/PP)_2O$, and $(Cr/sup III/PP)_2O$) leads to the deposition of thick (~ 1000 monolayer

equivalents), electroactive porphyrin films, which have been characterized by cyclic voltammetry and absorption spectroscopy on transparent SnO_2 electrodes. The films are stable toward organic solvents and aqueous acids and bases, but are removed by treatment with hot concentrated acids. The resonance Raman spectrum of the NiPP film indicates that one of the two vinyl groups is saturated on most of the porphyrin units. Deposition continues for some minutes after the current is interrupted. This evidence is consistent with a mechanism involving electroinitiated cationic vinyl polymerization. No film is formed if the metal, rather than the ring, is oxidized. Thus the first oxidation step of Co/sup II/PP, to [Co/sup III/PP]$^+$, does not support film formation (although the potential is as high as for ring oxidation in ZnPP), but the second step, to [Co/sup III/PP]$^{2+}$, does. Lack of film formation for (Mn/sup III/PP)Cl and (Cr/sup IV/PF)O suggests metal, rather than ring oxidation, to Mn/sup IV/ and Cr/sup V/. However, $(CrPP)_2O$ oxidation does produce a film, suggesting ring oxidation, analogous to $(FePP)_2O$, which also produces a film. However, while $(CrPP)_2O$ is incorporated intact into the film, the $(FePP)_2O$ film contains monomer units. Incorporation of other metal ions can be accomplished by soaking a ZnPP-coated electrode in H_2SO_4 followed by contact wtih a solution of the metal dihalide in refluxing DMF. The porphyrin sites are accessible to small ions, as shown by chloride coordination of ZnPP film upon soaking in chloride solution. 49 references, 13 figures, 1 table.

8167 **Electron-transfer barriers and metal-ligand bonding as a function of metal oxidation state. 2. Crystal and molecular structures of Tris(2,2'-bipyridine)cobalt(II) dichloride-2-water-ethanol and Tris(2,2'-bipyridine) cobalt(I) chloride-water.** Szalda, D.J.; Creutz, C.; Mahajan, D.; Sutin, N. (Brookhaven National Lab., Upton, NY). *Inorganic Chemistry;* **22**: No. 17, 2372-2379(17 Aug 1983).

The structures of tris(2,2'-bipyridine)cobalt(II) dichloride-2-water-ethanol, $[Co(C_{10}H_8N_2)_3]Cl_2 2H_2OC_2H_5OH$ (1), and tris(2,2'-bipyridine)cobalt(I) chloride-water, $Co(C_{10}H_8N_2)_3ClH_2O$ (2), have been determined in order to compare bonding of the high-spin d^7 and high-spin d^8 configurations and to better understand the electron-transfer reactivity of this couple. Compound 1 crystallizes in the hexagonal crystal system, space group $P6_522$, with a = 13.403 (2) A, c = 62.566 (10) A, and Z = 12. The structure refined to a final R value of 0.056. The coordination spere consists of the six nitrogen atoms of the three bipyridine ligands in an octahedral arrangement about the cobalt with an average Co-N bond length of 2.128 (8) A. One of the chloride ions is surrounded by twelve C-H Cl hydrogen bonds involving the H3 and H3' protons on the bipyridine ligands. Compound 2 crystallizes in the orthorhombic crystal system, space group $Pna2_1$, with a = 9.713 (6) A, b = 21.666 (10) A, c = 13.062 (7) A, and Z = 4. The structure refined to a final R value of 0.084. The geometry of the coordination sphere of 2 is almost identical with that of 1, with an average Co-N bond length of 2.11 (2) A. Hydrogen bonding between the H3 and H3' protons on the bipyridine ligand and the chloride ion is also observed in 2. The C-H Cl hydrogen bonding observed in these complexes and the bond length changes in 1, 2, and tris(2,2'-bipyridine)cobalt(III) are discussed and related to electron-transfer barriers for the series. 48 references, 1 figure, 9 tables.

8168 **X-ray diffraction and thermal analysis of molybdenum(VI) oxide hemihydrate: monoclinic MoO_3 1/2 H_2O.** Fellows, R.L.; Lloyd, M.H.; Knight, J.F.; Yakel, H.L. (Union Carbide Corp., Oak Ridge, TN). *Inorganic Chemistry;* **22**: No. 17, 2468-2470(17 Aug 1983). Contract W-7405-ENG-26.

Molybdenum(VI) oxide is known to form a rich family of crystalline hydrates that include a monoclinic dihydrate, $MoO_3 2H_2O$, two monohydrates, the yellow monoclinic MoO_3H_2O and the white triclinic MoO_3H_2O, and a white hemihydrate. A molybdenum oxide hemihydrate phase has been prepared during the study of molybdenum-containing preciptates from nitric acid solution. The range of preparative conditions and the stability of this hemihydrate in nitric acid, a thermogravimetric study of its decomposition and comparison with that of white triclinic MoO_3H_2O, and the results of an x-ray diffraction study are described. 12 references, 1 figure, 1 table.

8169 **Adsorbate band dispersions for C on Ru(0001).** Himpsel, F.J. (IBM T.J. Watson Research Center, Yorktown Heights, NY); Christmann, K.; Heimann, P.; Eastman, D.E.; Feibelman, P.J. *Surface Science;* **115**: 159-164(1982). Contract AC04-76DP00789.

Carbon-induced two-dimensional energy bands on Ru(0001) were studied by using angle-resolved photoelectron spectroscopy and were compared with ab initio calculations. A nearly parabolic band was found which was assigned to the C2p/sub z/ valence states of a graphitic carbon overlayer. Compared to graphite, these states are bound more tightly by 2.3 eV. 13 references, 3 figures.

8170 **Photoionization and photoelectron spectroscopy of alkali halide monomers, dimers, and trimers.** Berkowitz, J.; Batson, C.H.; Goodman, G.L. (Argonne National Lab., IL). *ACS Symposium Series;* No. 179, 275-299(1982). Contract W-31-109-ENG-38.

The ultraviolet photoelectron spectra of diatomic alkali halide molecules are reviewed and interpreted. Data for lithium halide dimers, Li_2X_2, are presented and it is shown that the dimers have significantly larger ionization thresholds than the corresponding monomers. Some historical controversies regarding the presence of dimers and their ionization energies are clarified. Photoionization mass spectrometry is used to determine the adiabatic ionization potential of lithium chloride trimer, in order to probe the trend of I.P. with cluster size. The predictions of Hartree-Fock, Xα and ionic model calculations on this point are presented. Finally, the very weak stability of M_2X_3+ and M_3X_3+ and the high stability of M_2X+ and M_3X_2+ are discussed, and conjectures are made regarding the geometric structure of these entities. 13 figures, 5 tables.

8171 **(LA-tr—83-30) Preparation and some properties of lanthanide (III) phythalocyanine complexes.** Mizumi, S.; Kasuga, K. Translated from *Nippon Kagaku Zasshi ;* **92**: No. 4, 335-338(1971). Contract W-7405-ENG-36. 14p. NTIS, PC A02/MF A01. Order Number DE84004259. DE84004259

Pc_2LnH-type complex (Pc: phthalocyanine negative ion; Ln: lanthanum (III), cerium (III), neodymium (III), europium (III), erbium (III), ytterbium (III) and PcLnX-type complex (X: univalent negative ion) were synthesized and their properties were analyzed. It was found that absorption bands in the ultraviolet and visible areas moved towards the short-wave side as the atomic number of lanthanum (III) element increased, and that in a solvent with a small amount of acid, Pc_2LnH-type changed into PcLnX-type. It was observed that by ultraviolet absorption spectrum, absorption band of 880 to 890 cm^{-1} (center metal-nitrogen rocking vibration) moved towards higher wave number as the atomic number of lanthanum (III) element increased. As a possible structure of Pc_2LnH-type complex, ferrocene-like sandwich structure was assumed.

4003 Organic Chemistry

REFER ALSO TO CITATION(S) 8166, 8189, 8197

8172 **(DOE/ER/72004—T2) Studies in spectroscopy and chemical dynamics. Technical progress report, 1 November 1981-30 September 1982.** Kuppermann, A. (California Inst. of Tech., Pasadena (USA). Div. of Chemistry and Chemical Engineering). 1 Oct 1982. Contract AT03-76ER72004. 79p. NTIS, PC A05/MF A01. Order Number DE84004954.

Modifications to the pulsed laser photoacoustic spectrometer are described. Two-color time-resolved photoacoustic spectroscopy was used to obtain the stimulated emission pumping spectrum of p-difluorobenzene. Detection of hydrogen molecules by laser fluorescence is possible. Electron-impact energy loss spectra were obtained for He, N_2, ethylene oxide, and cyclopropane. A rotational analysis was conducted on the pulsed laser photoacoustic spectra of CD_3H for several high vibrational states. (DLC)

8173 (INIS-mf—8536, pp 64) **Purification of labeled creatinine.** Eberstadt, P.; Liverant, J. (Universidad Nacional Autonoma de Mexico, Mexico City. Centro de Estudios Nucleares). 1982. (In Spanish). NTIS (US Sales Only), PC A05/MF A01. (CONF-820958—Summ.).

From 4. symposium on nuclear chemistry, radiochemistry and radiation chemistry; Mexico City, Mexico (7 Sep 1982).

Published in summary form only.

8174 **(JAERI-M—82-087) Oxidative degradation of powdered cation exchange resin by Fe(II) catalyzed hydrogen peroxide.** Matsuzuru, Hideo; Toshikuni, Masami; Yamanaka, Akihiro; Moriyama, Noboru. (Japan Atomic Energy Research Inst., Tokyo). Jul 1982. 23p. (In Japanese). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704098.

Oxidative degradation of a powdered cation exchange resin by Fe(II)-H_2O_2 has been studied using an apparatus of flow reactor type. The optimum Fe(II) concentration is found to be about 0.03 M, beyond which the amount of undissolved residual resin increases resulting in the lowering of the conversion of the resin. On the other hand the amount of dissolved residual organic carbon decreases with an increase of Fe(II) concentration. The conversion of resin is increased with increasing the amount of H_2O_2 added, but it does not increase significantly even when the amount of H_2O_2 is increased above 1.8 times of the amount calculated theoretically. After 1st treatment, about 5% of organic carbon loaded initially remain undegradated in the solution, however the residual organic carbon is converted to CO_2 nearly completely through analogous 2nd treatment. The ionic form of resin and the solution pH do not affect the conversion of the resin.

8175 **Absolute rate constants for the reaction of O(^{3}P) atoms with ethylene, propylene, and propylene-d6 over the temperature range 258—861 K.** Perry, R.A. (Combustion Chemistry Division, 8353, Sandia National Laboratories, Livermore, California 94550). *Journal of Chemical Physics;* **80**: No. 1, 153-158(1 Jan 1984).

Absolute rate constants for the reaction of O(^{3}P) with ethylene, propylene, and propylene-d6 were determined over the temperature range 258—861 K using a laser photolysis-chemiluminescence technique. The following empirical expressions are the best fits to the data: k/sub ethylene/ = 2.12 x $10^{-13}T^{-03}e^{-1370}$/sup /// sup R//sup T/, k/sub propylene/ = 3.40 x 10^{-19}T/sup 2.56/e/sup 1130/RT/, and k/sub propylene-d/6 = 3.40 x 10^{-19} T/sup 2.53/ e/sup 1210/R/T cm^3 molecule^{-1} s^{-1}. A simple transition state theory model is shown to provide a reasonable explanation for non-Arrhenius temperature behavior.

8176 **Laser-assisted isotope separation of tritium.** Herman, I.P.; Marling, J.B. (to Dept. of Energy). US Patent 4,411,755. 25 Oct 1983. Filed date 28 Nov 1980. vp.

PAT-APPL-210716.

Methods are disclosed for laser-assisted isotope separation of tritium, using infrared multiple photon dissociation of tritium-bearing products in the gas phase. One such process involves the steps of (1) catalytic exchange of a deuterium-bearing molecule XYD with tritiated water DTO from sources such as a heavy water fission reactor, to produce the tritium-bearing working molecules XYT and (2) photoselective dissociation of XYT to form a tritium-rich product. By an analogous procedure, tritium is separated from tritium-bearing materials that contain predominately hydrogen such as a light water coolant from fission or fusion reactors.

8177 **Partnership of gas-phase core and valence photoelectron spectroscopy.** Jolly, W.L. (Univ. of California, Berkeley). *Accounts of Chemical Research;* **16**: No. 10, 370-376(Oct 1983). Contract AC03-76SF00098.

The localized orbital ionization potential (LOIP), involving both core and valence ionization potentials, is a valuable aid in the assignment of valence-photoelectron spectra. Its primary value is to provide chemists with a reliable method for interpreting valence-shell ionization potentials in terms of the bonding or antibonding character of molecular orbitals. Typical applications are the determination of the degree of interaction of so-called lone-pair orbitals (mainly consisting of p or d orbitals) either with filled orbitals (bond breaking orbitals or other lone pairs) or with empty orbitals (antibonding orbitals or higher energy d orbitals). This method allows chemists to make these interpretations using only experimental data, free from most of the calculational problems and interpretive ambiguities associated with theoretical methods. 2 figures, 8 tables.

8178 **Fast heavy-ion induced desorption of biomolecules.** Hakansson, P.; Fohlman, J.; Johansson, A.; Kamensky, I.; Peterson, P.; Sundqvist, B. (Tandem Accelerator Lab., Uppsala). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 2, 1776-1778(Apr 1981). (CONF-801111—).

From 6. conference on application of accelerators in research and industry; Denton, TX, USA (3 Nov 1980).

Fast heavy-ion induced desorption of molecule ions from samples of cesium iodide, glycylglycine and ergosterol has been studied. Yields of molecule ions have been measured as a function of velocity and angle of incidence for many different primary ions. The yields are found to increase rapidly in the velocity region (2-3) X 10^8 cm/s independently of what type of fast heavy-ion was used. Yield distributions vs angle of incidence are different for different sample molecules.

8179 **Fourier transform infrared spectroscopic studies of the adsorption of benzene on alumina and alumina supported platinum.** Haaland, D.M. (Sandia National Labs., Albuquerque, NM). *Surface Science;* **102**: 405-423(1981). Contract AC04-76DP00789.

Fourier transform ir spectroscopy has been used to study the adsorbed state of benzene and its deuterium derivative (C_6H_6 and C_6D_6) on γ-alumina (γ-Al_2O_3) and alumina-supported platinum (Pt) catalysts at 300°K. Benzene physisorbs on the alumina support with an ir spectrum similar to that of liquid benzene. However, small increases in the energy of combination bands involving out-of-plane hydrogen vibrations and the formation of perturbed hydroxyl groups on the alumina surface indicate tht the adsorption of benzene in this case is the result of the interaction of the π-electrons with the OH groups on alumina. This had been observed previously for benzene physisorbed on silica. On Pt/Al_2O_3, benzene chemisorbs on the Pt metal and physisorbs on the Al_2O_3 support. The observation of E/sub 1u/ and B/sub 2u/ vibrations of chemisorbed benzene on Pt (i.e., 3050, 1398, 1274, 1147, and 1042 cm^{-1} for C_6H_6 and 2260, 1268, and 1230 cm^{-1} for C_6D_6) indicates that chemisorbed benzene is distorted to C/sub 3v/ symmetry. The distortion is such that the chemisorbed benzene has alternating long and short C-C bonds. Thus, benzene approaches the classical Kekule structure (i.e., cyclohexatriene) upon adsorption on Pt. The resultant loss in energy of resource allows benzene to be readily hydrogenated on Pt/Al_2O_3. The deconvolution of the broad C-H stretching vibration shows it to be composed of four bands. This is interpreted as caused by benzene molecules adsorbed on several crystalline sites of the polycrystalline Pt/Al_2O_3 catalyst. 7 figures, 2 tables.

4004 Electrochemistry

REFER ALSO TO CITATION(S) 7990

8180 **(EUR—8632-FR) Study of the development of cationic-conductive solid electrolytes for water electrolysis for hydrogen production. Final report.** Masson, J.P. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France)). 1983. 34p. (In French). European Community Information Service (ECIS), 2100 M Street N.W., Suite 707, Washington, DC 20037.

Purpose was to develop electrolysis modules for life tests on these membranes close to real industrial conditions (80 to 100°C, 5 to 10 kAm^{-2}) and to design an integrated membrane-electrodes assembly, incorporating electrocatalytic coatings. A chemical deposition method was adopted which consists in impregnating the membrane with sodium borohydride and then contacting it with a metal salt solution. Working conditions were chosen to obtain Pt or Ru coatings 1 μm thick. X-ray diffraction, scanning electron microscopy and x-ray microfluorescence showed these coatings to be amorphous and porous. A two-cell filter-press electrolysis module

was built, capable of a 200 A nominal current. Modifications were made to achieve the application of the contact plates with an even pressure onto the whole surface of the membrane. A satisfactory 200 h run was conducted at 60°C. 0.5% oxygen was found in hydrogen and 1.5% hydrogen in oxygen. The electrolysis stopped due to a short-circuit. Further trials resulted in rapid deteriorations of the membranes causing overheating, performation and intermixing of gases. Post-mortem examinations revealed a decrease of both conductivity and ion exchange capacity. Despite their promising behavior at low current densities, this type of polyethylene-based membranes are not likely to withstand the severe working conditions.

8181 **The effect of pressure on the product distribution in Kolbe electrolysis.** Sanderson, J.E.; Barnard, G.W.; Cheng, L.K.; Levy, P.F. (Dynatech Research and Development Company, Chemical Engineering Group, Cambridge, Massachusetts). *Journal of the Electrochemical Society;* **130**: No. 9, 1844-1848(Sep 1983). Contract AC02-81ER10914.

Experiments have been run which demonstrate that electrochemical oxidation of n-alkanoic acids (in the range of C_4-C_8) in aqueous solution at a smooth platinum anode gives higher yields of alkane dimer product when run at elevated pressures than an equivalent experiment at atmospheric pressure. This phenomenon has been observed over a wide range of reaction conditions. A plausible explanation for this result is that under high pressure conditions, olefin accumulates at the anode surface which helps to prevent the water, required to stabilize intermediates in the formation of competitive products, from reaching the electrode surface.

8182 **The potential of zero charge of Oriented single-crystal RuO_2 in Aqueous Electrolytes.** Tomkiewicz, M.; Huang, Y.S.; Pollak, F.H. (Dept. of Physics, Brooklyn College, City University of New York, Brooklyn, NY). *Journal of the Electrochemical Society;* **130**: No. 7, 1514-1518(Jul 1983). Contract AC02-80ER10654.

The impedance of 5 virgin faces of single crystal RuO_2 was measured over the frequency range of 1-10^6Hz, in three electrolytes--10^{-3}M and 1M Na_2SO_4 and 10^{-3}M KF. The fastest relaxing capacitive element was identified, and its values measured as a function of the electrode potential. A major contribution to this capacitance is due to the double layer capacitance. The potential of zero charge in 10^{-3}M Na_2SO^4 was measured for the five crystalline faces. The variations of the potential of zero charge with the crystalline faces are small. "Average" value is (-0.09 + or - 0.1) V vs. SCE. The potential of zero charge correlates well with the reported work functions of RuO_2 and Ru metal.

8183 **Two-plateau rechargeable sodium/sulfur(IV) molten chloroaluminate cell.** Mamantov, G.; Ogata, Y.; Tanemoto, K. (Department of Chemistry, University of Tennessee, Knoxville, Tennessee). *Journal of the Electrochemical Society;* **130**: No. 7, 1528-1531(Jul 1983).

The behavior of the rechargeable cell Na/B''-alumina/SCl_3^+ in molten $AlCl_3$-NaCl under conditions in which S(IV) is reduced to S(-2) is described. It is shown that the use of reticulated vitreous carbon as the positive current collector and high concentrations of active material result in cells which operate at temperatures ≦ 220°C and have very high energy densities (≧ 450 W-hr/kg).

4005 Photochemistry

8184 **(CONF-820853—Absts.) Photophysics and photochemistry in the vacuum-ultraviolet.** (Louisiana State Univ., Baton Rouge (USA)). 1982. Contract AS05-76EV03018. 362p. NTIS, PC A16/MF A01. Order Number DE83017399.

From NATO conference on photophysics and photochemistry in the vacuum ultraviolet; Lake Geneva, WI, USA (15 Aug 1982).

Portions are illegible in microfiche products.

Seventeen abstracts, papers and reviews are included. (DLC)

4006 Radiation Chemistry

REFER ALSO TO CITATION(S) 8009, 8015, 8193, 8293, 8618

8185 **(BARC—1165) Radiation chemical investigations of Fricke solution using 30 MeV alpha beam from cyclotron.** Saini, R.D.; Ruikar, P.B.; Saha-Kundu, S.M.; Bhattacharyya, P.K. (Bhabha Atomic Research Centre, Bombay (India)). 1982. 15p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704103.

Systematic investigations on the radiolysis of liquid systems using 30 MeV alpha beam from cyclotron at the Variable Energy Cyclotron Centre (VECC) have been initiated. A liquid target assembly incorporating current measurement devices in solution as well as on the target assembly window has been designed. Suitable aluminium absorbers of different thickness have been used to extract different energies of alpha ranging from 24.82 MeV to 6.41 MeV corresponding to the LET range of 2.77 eV/A° to 7.98 eV/A°. A fricke solution using 10 mM Fe^{2+} in 0.8 NH_2SO_4 in presence of 5mM NaCl under continuous oxygen bubbling has been radiolysed with radiation of different LET. The effect of LET on the G(Fe^{3+}) has been investigated and the results are discussed.

8186 **(IAE—3504/3) Physicochemical processes in track of fission recoil.** Dorofeev, Yu.N.; Krasnoshtanov, V.F.; Khodulev, L.B. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1981. 15p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704104.

An attempt is made to consider in succession the processes involving free electrons in a nuclear fission fragment track. First the dynamic stage of the electron divergence from the primary ionization region is investigated, and the energy carried away by delta-electrons and "locked" in the vicinity of the track is calculated. Then the interaction between the "locked" electrons and ions is considered as well as the mechanism of structural defect formation in solid dielectrics. And, finally, the process is studied of water vapor and carbon dioxide radiolysis in a fission fragment track taking into account ionization, and electronic and oscillatory excitation of molecules by delta-electrons. Analyzing the dynamic stage of the electron divergence from the fission fragment track has shown that the energy of "locked" electrons increases logarithmically with the density of matter. For the density of a solid it makes up about half of all the fission fragment losses. This energy is sufficient for displacing the lattice ions and for formation of structural defects in solid dielectrics. At lower densities of matter ($n_0 <= 10^{22}$ cm^{-3}) the main part of the fission fragment energy is transferred to delta-electrons and spent primarily for ionization, and electronic and oscillatory excitation of the matter molecules. A possibility of using the processes of water vapor- and CO_2 radiolysis for production of synthetical fuel and hydrogen is shown to be promising.

8187 **(INIS-mf—8290) Development of a process for continuous, radiation-chemically initiated, catalytic hydrocarboxylation.** Laege, J. (Technische Hochschule Aachen (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet). 27 Nov 1980. 225p. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE84700206.

In the general part are treated technical preparation of aliphatic carboxylic acids and their economical importance, the hydrocarboxylation reaction and general aspects of radiation chemistry. The chapter on results of discontinuous experiments contains experiments of radiochemically initiated catalytical hydroesterification of oct-1-ene and butene oxide. The chapter on development and arrangement of the continuously working hydrocarboxylation plant deals with the disposition of process flow sheet, single elements of and description of the plant. The chapter on results of continuous experiments describes residence time behaviour of the tube reactor, investigations on the mixing behaviour of adducts, influence of residence time and reaction pressure on continuous thermal and thermal-radiochemical hydrocarboxylation. The next chapter proposes a procedure of continuous hydrocarboxylation and esterification at high pressure on an industrial scale. The experimental

part presents starting materials, preparation of catalysts and reference substances, performance of discontinuous autoclave experiments, work up and investigation of reaction products, performance of continuous high pressure experiments, Co-60-source, Fricke-dosimetry and analytics. (SPI).

8188 **Subnanosecond time-resolved optical absorption studies of electron solvation in ice.** Warman, J.M. (Interuniversity Reactor Inst., Delft, Netherlands); Kunst, M.; Jonah, C.D. *Journal of Physical Chemistry;* 87: No. 21, 4292-4294(13 Oct 1983).

Optical absorption studies of pulse-irradiated ice have been carried out with subnanosecond time resolution. A growth in the solvated electron absorption is observed with a risetime of 450 ps at -5°C. The activation energy for relaxation of the matrix following localization is 0.3 eV. Below -35°C localization at trapping sites becomes the rate-controlling step in solvation. Addition of 10^{-2}M NH_4F considerably increases the overall solvation time by reducing the initial rate of dry electron localization at defects. A second absorbing species is produced immediately in the pulse with a yield $G\epsilon_{890} = 9 \times 10\ M^{-3}\ cm^{-1}\ (100\ eV)^{-1}$, which is independent of temperature. This is tentatively ascribed to an exciton state. 4 figures, 1 table.

8189 **Reduction potentials for 2,2'-bipyridine and 1,10-phenanthroline couples in aqueous solutions.** Krishnan, C.V.; Creutz, C.; Schwarz, H.A.; Sutin, N. (Brookhaven National Lab., Upton, NY). *Journal of the American Chemical Society;* 105: No. 17, 5617-5623(24 Aug 1983).

From pulse-radiolysis studies of 2,2'-bipyridine (bpy), 1,10-phenanthroline (phen), and 4,4'-dimethyl-2,2'-bipyridine ($(CH_3)_2$bpy) and an analysis of the pH and free-energy dependence of the rate constants for quenching of poly(pyridine)-ruthenium(II) excited states by the above aromatic amines (L) and their protonated counterparts (LH^+, LH_2^{2+}), the following parameters concerning L and its one-electron reduction product L^- have been deduced at 25°C: for L = bpy, pK/sub a/(LH_2^{2+}) = 0.05, pK/sub a/(LH^+) = 4.4, pK/sub a/(LH_2^+) = 8.0, pK/sub a/(LH) ≃ 24, $E°(LH_2^{2+}\text{-}LH_2^+)$ = -0.50 V, $E°(LH^+\text{-}LH)$ = -0.97 V; for L = phen, pK/sub a/(LH_2^{2+}) = -0.2, pK/sub a/(LH^+) = 4.9, pK/sub a/(LH) ≃ 24, $E°(LH_2^{2+}\text{-}LH_2^+)$ = -0.47 V, $E°(LH^+\text{-}LH)$ = -0.85 V; and for L = $(CH_3)_2$bpy, pK/sub a/(LH_2^{2+}) = 0.68, pK/sub a/(LH_2^+) = 9.3, pK/sub a/(LH) ≃ 25, $E°(LH_2^{2+}\text{-}LH_2^+)$ = -0.54 V, $E°(LH^+\text{-}LH)$ = -1.05 V. The reduction potentials and other electron-transfer parameters of these and related couples are discussed. 29 references, 7 figures, 4 tables.

8190 **Radiation induced conductivity in liquefied rare gases.** Mozumder, A. (Univ. of Notre Dame, IN). *Journal of Electrostatics;* 12: 45-57(1982).

Theory of electron thermalization, at various levels of sophistication, has been applied to calculate thermalization time and width of thermalization distance distribution with special reference to liquefied argon (LAr). The different approaches give the thermalization time ~ 1 ns. However the thermalization distance parameter (b-value), using cross-sections according to the Cohen-Lekner theory, calculates in the range 845 to 1142 nm which is a factor ~ 3.6 to 4.8 larger than that inferred from free-ion yield measurements. The difference can be attributed to the effect of the Coulombic field of the geminate (+ve) ion. The implication is that the mean free path for both momentum and energy transfer in the presence of the Coulombic field is the same and that it lies in the range 4 to 6 A. 6 figures.

4007 Radiochemistry And Nuclear Chemistry

REFER ALSO TO CITATION(S) 8215, 8590

8191 **(BARC—1160) Radiochemistry Division: annual progress report for 1980.** Jayadevan, N.C.; Manohar, S.B. (eds.). (Bhabha Atomic Research Centre, Bombay (India)). 1982. 102p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE83704099.

The research and development (R and D) activities of the Radiochemistry Division of the Bhabha Atomic Research Centre (BARC), Bombay, during 1980 are reported in the form of individual summaries under the headings: reactor chemistry, heavy element chemistry, process chemistry (of actinides), nuclear chemistry and instrumentation. Some of the highlights of the R and D activities are: (1) setting up of the facilities for the prepa.ration of $(U,Pu)O_2$ microspheres by sot-gel process on laboratory scale, (2) studies on synergistic extraction of Am, Cm, Bk, Cf, Th(IV), Np(IV) and Pu(IV) with mixtures of TTA and oxodonor6s like TBP, (3) kinetics of radiation induced oxidation of Pu(IV) and that of reduction of Pu(VII), (4) determination of fission yields of ^{136}Xe, ^{139}Cs, ^{252}Cf and ^{230}Th, (5) measuring of gamma ray abundance of ^{230}Th and isotopic ratios in thorium and plutonium and (6) design and fabrication of an osmistor for the determination of the molecular weight of actinide complexes. A list of papers published in journals and papers presented at conference/symposia during the year is also given.

8192 (INIS-mf—8536, pp 50) **Use of small amounts (approximately μCi) of various radioisotopes for exciting characteristics x-rays for XRF analysis.** LaBrecque, J.J.; Parker, W.C. (Instituto Venezolano de Investigaciones Cientificas, Caracas. Dept. de Quimica). 1982. NTIS (US Sales Only), PC A05/MF A01. (CONF-820958—Summ.).

From 4. symposium on nuclear chemistry, radiochemistry and radiation chemistry; Mexico City, Mexico (7 Sep 1982).

Published in summary form only.

8193 **(INIS-mf—8536) 4. Symposium on nuclear chemistry, radiochemistry and radiation chemistry, University City, Mexico 7-10 September 1982 - Review.** Collins, C.H.; Collins, K.E.; De Andrade, J.C.; Yoshikawa, O.A.E.; Lancas, F.M. (Universidad Nacional Autonoma de Mexico, Mexico City. Centro de Estudios Nucleares). 1982. 35p. (CONF-820958—Summ.). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84780043.

From 4. symposium on nuclear chemistry, radiochemistry and radiation chemistry; Mexico City, Mexico (7 Sep 1982).

Individual items in scope for the data base are processed separately.

8194 **(JINR-R—6-82-616) Experimental approach to chemical identification of element 107 as ekarhenium. 2. Search for spontaneously fission isotopes of element 107 in products of the $^{249}Bk + {}^{22}Ne$ reaction using the method of thermochromatography.** Zvara, I.; Domanov, V.P.; Khyubener, Z.; Shalaevskij, M.R.; Timokhin, S.N.; Zhujkov, B.L.; Ajkhler, B.; Buklanov, G.V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1982. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704102.

The recently developed fast procedure of continuous thermochromatographic separation of a volatile oxygen compound of radiorhenium (^{177}Re) was used to perform experiments aimed at searching for spontaneouly fissioning nuclei of element 107, that might be formed in the bombardment of a berkelium-249 targetby accelerated neon-22 ions. The detection of spontaneous fission was accomplished by quartz detectors placed in thermochromatographic columns. The necessary decontamination factor ($> 10^4$) was achieved in the zone where the deposition of ekarhenium was expected. No tracks of spontaneous fission fragments have been detected; in terms of the effective cross section for the formation of element 107 the sensitivity of our experiments for isotopes with half-lives in the range approximately 2 s to approximately 5×10^4 s reached $10^{-34}\ cm^2$.

8195 **(JINR-R—12-82-529) Chemical concentration of a new natural spontaneously fissionable nuclide from solutions with low salt background.** Korotkin, Yu.S.; Ter-Akop'yan, G.M.; Popeko, A.G.; Drobina, T.P.; Zhuravleva, E.L. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1982. 18p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704101.

The results of experiments on further concentration of a new natural spontaneously fissionable nuclide, the concentrates of which

form the Cheleken geothermal brines, are presented. The conclusions are drawn about the chemical nature of a new spontaneously fissionable nuclide. It is a chalcophile element which copreipitates with sulphides of copper, lead, arsenic and mercury from weakly acid solutions. The behaviour of the new nuclide in sulphide systems in many respects is similar to the behaviour of polonium, astatine and probably of bismuth. The most probable stable valence of the new nuclide varies from +1 up to +3. The data available on the chemical behaviour of the new nuclide as well as the analysis over contamination by spontaneously fissionable isotopes permit to state that the new natural spontaneously fissionable nuclide does not relate to the known isotopes.

8196 **(LBL—16690) Behavior of americium in aqueous carbonate systems.** Silva, R.J. (Lawrence Berkeley Lab., CA (USA)). Nov 1983. Contract AC03-76SF00098. 10p. (CONF-831174—51). NTIS, PC A02/MF A01. Order Number DE84004882.

From Materials Research Society annual meeting; Boston, MA, USA (14 Nov 1983).

The solubilities of crystalline $Am(OH)_3$ and $AmOHCO_3$ were measured at 25°C in aqueous solutions of 0.1 M $NaClO_4$ by determination of the solution concentrations of Am. Prior to use in the measurements, the solid materials were characterized by their x-ray powder diffraction patterns. The solubility product quotients were calculated from the experimental data. The hydrolysis quotients of Am^{3+} were also estimated from the hydroxide solubility data. Using the thermodynamic data derived from these experiments and the recently reported formation constants for the Am^{3+} carbonate complexes, the solid phases and concentrations of solution species of americium in several aqueous carbonate systems were calculated using the computer code MINEQL. 20 references, 1 figure, 1 table.

8197 **Organo-f-element thermochemistry. Metal-ligand bond disruption enthalpies in (pentamethylcyclopentadienyl)thorium hydrocarbyls, metallacycles, hydrides, and dialkylamides.** Bruno, J.W.; Marks, T.J.; Morss, L.R. (Argonne National Lab., IL). *Journal of the American Chemical Society;* 105: No. 23, 6824-6832(16 Nov 1983). Contract W-31-109-ENG-38.

Thorium-ligand bond disruption enthalpies (D) have been determined in the series $Cp'_2Th(thorium)R_2$ (Cp' = eta^5-(pentamethylcyclo-pentadienyl-$(CH_3)_5C_5$) for a range of R groups including R = alkyl, aryl, metallacycle, hydride, and dialkylamide. Enthalpy data were obtained in an anaerobic batch-titration isoperibol reaction calorimeter from heats of solution in toluene followed by heats of alcoholysis with tert-butyl alcohol. Calculated Th-hydrocarbyl bond disruption enthalpies fall in the range 60 to 90 kcal/mol, with $C_6H_5 > CHa3 \simeq CH_2Si(CH_3)_3 > CH_3CH_3 \geqq CH_3C_6H_5 \simeq$ n-$C_4H_9 \simeq CH_2C(CH_3)_3$. Th-C bonds appear to be strengthened by ThOR coligands and possibly weakened by Th-Cl coligands. The strain energies in thoracyclobutanes $Cp'_2Th(CH_2)_2C(CH_3)_2$ and $Cp'_2Th(CH_2)_2Si(CH_3)_2$ are estimated to be ca. 16 and 8 kcal/mol, respectively. A Th-H bond is ca. 20 kcal/mol stronger than a Th-alkyl bond, while a Th-NR_2 bond is ca. 18 kcal/mol stronger. These data afford a considerably expanded understanding of organoactinide reaction patterns involving C-H activation, β-hydride elimination, and CO insertion as well as why they sometimes differ from those of middle and late first-row transition elements. 3 figures, 2 tables.

8198 **Rate and mechanism of facilitated americium(III) transport through a supported liquid membrane containing a bifunctional organophosphorus mobile carrier.** Danesi, P.R.; Horwitz, E.P.; Rickert, P.G. (Argonne National Lab., IL). *Journal of Physical Chemistry;* 87: No. 23, 4708-4715(10 Nov 1983). Contract W-31-109-ENG-38.

The facilitated transport of Am(III) from aqueous nitrate solutions to formic acid aqueous solutions through a supported liquid membrane (SLM) is described. The supported liquid membrane consists of a solution of a new (carbamoylmethyl)phosphine oxide in diethylbenzene (DEB) absorbed into a 48 μm thick microporous polypropylene film. The transport mechanism consists of a diffusion process through an aqueous diffusion film, a fast interfacial chemical reaction, and diffusion through the membrane itself. Equations describing the rate of transport are derived. They correlate the membrane permeability coefficient to diffusional parameters and to the chemical composition of the system. Different rate-controlling processes are shown to control the membrane permeability when the composition of the system is varied and as long as the transport occurs. The experimental data are quantitatively explained with the derived equations. The diffusion coefficient of the permeating species and the equilibrium constant of the fast interfacial reactions are evaluated. 13 figures, 1 table.

8199 **Nuclear magnetic resonance and chemical studies of uranium(V) alkoxides.** Eller, P.G.; Vergamini, P.J. (Washington State Univ., Pullman). *Inorganic Chemistry;* 22: No. 22, 3184-3189(26 Oct 1983).

The following uranium (V) alkoxides have been synthesized: uranium pentamethoxide $U(OCH_3)_5$, the pentaethoxide $U(OCH_2H_3)_5$, the pentaphenoxide $U(OC_6H_5)_5$; U[tetra (nonafluoro-2 methyl-2-propoxide](ethoxide)(ethanol), U[tetra(hexafluoro-2-propoxide)] (ethoxide)(ethanol); U[(penta(pentafluorophenoxide)](ethanol). The compounds have been characterized by high-resolution ^{13}C, ^{19}F, and ^1H NMR spectroscopy. Well-resolved, temperature dependent ^{13}C spectra were obtained for $U(OCH_2H_3)_5$ and $U(OC_6H_5)_5$, indicative of rapid ligand exchange at ambient temperature and slower exchange and/or molecular association at lower temperatures. Reactions of $U(OCh_2CH_3)_5$ with SO_2, pyridine, acetonitrile, oxygen, nitric oxide, 18-crown-6 and hydrofluoric acids are discussed. 3 figures, 2 tables.

8200 **Syntheses and crystal structures of the tetrakis(methyltrihydroborato) compounds of zirconium(IV), thorium(IV), uranium(IV), and neptunium(IV).** Shinomoto, R.; Gamp, E.; Edelstein, N.M.; Templeton, D.H.; Zalkin, A. (Univ. of California, Berkeley). *Inorganic Chemistry;* 22: No. 17, 2351-2355(17 Aug 1983). Contract AC03-76SF00098.

$Zr(BH_3CH_3)_4$, $Th(BH_3CH_3)_4$, $U(BH_3CH_3)_4$, and $Np(BH_3CH_3)_4$ have been synthesized and their molecular structures determined by single-crystal x-ray diffraction. Infrared spectroscopy and nuclear magnetic resonance data are presented for the Zr, Th, and U compounds. The space groups, unit cell parameters, and R factors are as follows: $Zr(BH_3CH_3)_4$, tetragonal, $P4_2/n$, a = 10.311 (6) A, c = 5.851 (3) A, Z = 2, d/sub x/ = 1.103 g/cm^3, R = 0.013 ($F^2 > 3\sigma(F^2)$); $Th(BH_3CH_3)_4$, triclinic, P1, a = 18.408 (6) A, b = 16.910 (6) A, c = 8.834 (3) A, α = 88.06 (4)°, β = 90.83 (4) °, γ = 88.08 (4)°, Z = 8, d/sub x/ = 1.681 g/cm^3, R = 0.068 ($F^2 > 3\sigma(F^2)$); $U(BH_3CH_3)_4$, monoclinic, $P2_1n$, a = 18.228 (6) A, b = 16.749 (6) A, c = 8.765 (2) A, β = 90.69 (4)°, Z = 8, d/sub x/ = 1.755 g/cm^3, R = 0.041 ($F^2 > 3\sigma(F^2)$); $Np(BH_3CH_3)_4$, tetragonal, $P4_2/n$, a = 10.552 (6) A, c = 5.950 (3) A, Z = 2, d/sub x/ = 1.767 g/cm^3, R = 0.016 ($F^2 > 3\sigma(F^2)$). All compounds are monomolecular in the crystalline state. The metal atoms are tetrahedrally coordinated to the four BH_3CH_3 groups through tridentate hydrogen bridges. The M-B distances are 2.335 +- 0.003 A for Zr, 2.56 +- 0.05 A for Th, 2.49 +- 0.02 A for U, and 2.487 +- 0.006 A for Np. 17 references, 3 figures, 5 tables.

8201 **Chemistry of radon.** Stein, L. *Radiochimica Acta;* 32: No. 1-3, 163-171(1983). Contract W-31-109-ENG-38.

The chemistry of radon, the heaviest noble gas, is reviewed. No stable isotopes of radon exist, hence the chemistry has been explored by tracer methods. The following topics are treated: early chemical experiments with ^{220}Rn ("Thoron") and ^{222}Rn ("Radon"); preparation and properties of clathrate compounds, simple and complex fluorides, and solutions of ionic radon; unsuccessful efforts to prepare an oxide and halides other than the fluoride; reduction of oxidized radon in aqeous solutions; mass spectrometric studies of radon compounds; coprecipitation of radon and xenon fluorides; behaviour of radon implanted in solids by electric discharges; removal of radon from air with solid and liquid oxidants; analysis of radon with solid oxidants; and separation of radon and xenon by selective oxidation.

8202 **Equilibrium sorption of Am(III), Ce(III), and Eu(III), on biorex 70 ion exchange resin.** Choppin, G.R.; Ohene-Aniapam, F. (Florida State Univ., Tallahassee). *Solvent Extraction and Ion Exchange;* 1: No. 3, 585-595(1983).

The binding of cerium III [Ce(III)], europium III [Eu(III)], and americium III [Am(III)] to a weak carboxylic acid ion exchange resin was measured at several temperatures. The thermodynamic values correspond to contact ion-pair formation of the trivalent cations with the carboxylic sites. The results of this study of binding of lanthanides and actinides to a weak carboxylic acid resin are compared to analogous data for a strong sulfonic acid ion exchange resin. 2 figures, 3 tables.

8203 **Labelling of bilirubin with /sup 99m/Tc and pharmacokinetic behavior.** Kaempfer, L.; Schneider, G.; Blottner, A.; Deckart, H. (Karl-Marx-Universitaet, Leipzig (German Democratic Republic). Bereich Medizin; Staedtisches Klinikum Berlin-Buch (German Democratic Republic). Nuklearmedizinische Klinik). pp 104-108 of 18. symposium of the Sektion Nuklearmedizin der Gesellschaft fuer Medizinische Radiologie der DDR. Proceedings. Berlin, Germany, DDR; Tsocommerz G.m.b.H (1982). (In German)(CONF-811291—).

From 18. symposium on nuclear medicine; Reinhardsbrunn, German D.R. (7 Dec 1981).

The yield of the bilirubin labelling with /sup 99m/Tc amounted to 97%. The labelled complex has been stable for 24 hours with the pH range 2-7.5. As evidenced in animal experiments the labelled bilirubin is probably subjected to natural degradation processes. Side effects could not be noticed. A disadvantage seems to be the slow transfer of /sup 99m/Tc-bilirubin from the hepatic cell to the biliary capillary.

4008 Combustion, Pyrolysis, And High-temperature Chemistry

8204 **(DOE/PC/40283—1) Fundamental and semi-global kinetic mechanisms of hydrocarbon combustion. Final report, 1 July 1981-30 June 1983.** Brezinsky, K.; Dryer, F.L. (Princeton Univ., NJ (USA). Dept. of Mechanical and Aerospace Engineering). Oct 1983. Contract FG22-81PC40283. 15p. NTIS, PC A15/MF A01. Order Number DE84004225.

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This program developed and significantly expanded the available data base at intermediate temperatures (~ Ca 1000 K) on the oxidation characteristics of higher carbon number paraffins including, n-butane, iso-butane, n-octane and 2,2,4 tri-methyl pentane (iso-octane). These data provide insight into the intermediates and products formed at atmospheric pressure during oxidation of these species over a range of equivalence ratios from fuel-lean to fuel-rich conditions. This reversible semi-empirical model and similar mechanisms with overall rate parameters developed from the experimental work described were evaluated by comparing predictions with the experimental data from this program as well as literature data available from shock tubes. By modifying only the fuel conversion rate to intermediate species, acceptable reproducibility of intermediate and final product evaluation at intermediate temperatures, and ignition delay phenomena at shock tube temperatures could be achieved, for n-butane, iso-butane, and n-octane. Intermediate product characteristics for iso-octane are different than that of the other fuels studied, and the model considered was not extendable to this fuel. The program also continued expansion of understanding for the oxidation of simple aromatic structures through additional flow reactor studies on benzene, toluene, and ethylbenzene. These data were used to formulate a general mechanism for the oxidation of simple ring compounds, and to point to the important phenomena which should be considered in developing an empirical description of the chemistry for combustion modelling.

8205 **(PNL—4917) Efficiency evaluation of oxygen enrichment in energy conversion processes.** Bomelburg, H.J. (Pacific Northwest Lab., Richland, WA (USA)). Dec 1983. Contract AC06-76RL01830. 103p. NTIS PC A06/MF A01. Order Number DE84004164.

The extent to which energy conversion efficiencies can be increased by using oxygen or oxygen-enriched air for combustion was studied. Combustion of most fuels with oxygen instead of air was found to have five advantages: increases combustion temperature and efficiency, improves heat transfer at high temperatures, reduces nitrous oxide emissions, permits a high ration of exhaust gas recirculation and allows combustion of certain materials not combustible in air. The same advantages, although to a lesser degree, are apparent with oxygen-enriched air. The cost-effectiveness of the process must necessarily be improved by about 10% when using oxygen instead of air before such use could become justifiable on purely economic terms. Although such a modest increase appears to be attainable in real situations, this study ascertained that it is not possible to generally assess the economic gains. Rather, each case requires its own evaluation. For certain processes industry has already proven that the use of oxygen leads to more efficient plant operation. Several ideas for essentially new applications are described. Specifically, when oxygen is used with exhaust gas recirculation in external or internal combustion engines. It appears also that the advantages of pulse combustion can be amplified further if oxygen is used. When burning wet fuels with oxygen, direct steam generation becomes possible. Oxygen combustion could also improve processes for in situ gasification of coals, oil shales, peats, and other wet fuels. Enhanced oil recovery by fire flooding methods might also become more effective if oxygen is used. The cold energy contained in liquid oxygen can be substantially recovered in the low end of certain thermodynamic cycles. Further efforts to develop certain schemes for using oxygen for combustion appear to be justified from both the technical and economic viewpoints.

8206 **Measurement of ammonia in lean combustion exhaust gases.** Lucas, D.; Brown, N.J.; Newton, A.S. (Lawrence Berkeley Lab., CA). *Combustion Science and Technology;* **29**: 309-318(1982). Contract W-7405-ENG-48.

Discussed are several techniques commonly used for measuring ammonia (NH_3) in lean combustion systems. The findings are summarized by listing the resolution, sensing limit, accuracy, analysis time, interferences, and a qualitative assignment of the ease of analysis of the following methods; sodium phenolate, chemiluminescent method, ion selective electrode analysis, length of stain tube, and gas chromatographic methods for measuring the amount of ammonia. Because of the problems which plague these techniques, more than one method may be required to insure the accuracy of samples. 3 figures, 3 tables.

8207 **Comparative study of HCl and HBr combustion inhibition.** Schefer, R.W.; Brown, N.J. (Lawrence Berkeley Lab., CA). *Combustion Science and Technology;* **29**: 113-128(1982). Contract W-7405-ENG-48.

A modelling study of combustion inhibition in an idealized well-stirred reactor utilizing $H_2/O_2/Ar$ mixtures as the reactants is presented and discussed. The effect of two chemical inhibitors, hydrochloric acid (HCl) and hydrobromic acid (HBr), on the combustion process has been investigated at pressures of 0.01 and 1.0 atmosphere over a range of equivalence ratios of 0.5 to 1.5 and inhibitor concentrations of 0 to 10 percent. Inhibitor effectiveness was determined by the competition between the radical scavenging ability of an inhibitor and the exothermicity of the scavenging reactions. For all cases considered HBr was more effective in scavenging active radicals than HCl. At 0.01 atmospheres, HCl was a more effective inhibitor in lean and stoichiometric mixtures while HBr was more effective for rich mixtures at 0.01 atmosphere and for all atmospheric pressure mixtures. 8 figures, 6 tables.

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4201 General Engineering

REFER ALSO TO CITATION(S) 7898

8208 **(DOE/ER/10473—T1) Lubrication and support of a single piston ring.** Hoult, D.P. (Massachusetts Inst. of Tech., Cambridge (USA)). 1983. Contract AC02-79ER10473. 12p. NTIS, PC A02/MF A01. Order Number DE84004368.

This paper describes a generalized approximation scheme which is used in modeling piston ring motion, oil flow, and friction in internal combustion engines. Trial calculations are presented, and

current weaknesses in the theory for an oil lubricated ring are discussed. As an exercise of the theory, a novel gas lubricated ring is presented, which has very low friction.

8209 **(NMRC—83-01) National measurement requirements survey, 1982.** (National Measurement Requirements Committee, Washington, DC (USA)). May 1983. 177p. NTIS, PC A09/MF A01. Order Number DE84900498.

During 1982, a survey of over 1400 United States companies, government organizations, and universities was conducted to assess our overall National measurement requirements. The broad objectives of this survey were to: identify requirements for new or improved calibration services from the National Bureau of Standards (NBS) that are necessary for National Interests including commerce, international competitiveness and defense preparedness; and identify new measurement requirements to establish or improve technical, quality and productivity aspects of individual organizations. The survey was conducted in two parts. Part I was used to assess the scope of the National measurement requirements and identify organizations with specific needs for further study. Part II of the survey was forwarded only to those organizations which had indicated a need for: (1) a new or improved NBS calibration service; or (2) a new or improved local measurement capability beyond what could be obtained commercially. The responses to the survey have been reviewed in depth by NMRC technical subcommittees comprised of industry and government metrology experts, and discussed in detail in subcommittee meetings and workshops. The results of the subcommittee reviews are presented in this report for use by industry, the National Bureau of Standards, and other government organizations, and universities to aid in guiding efforts necessary to maintain this Nation's leadership in the world.

4202 Facilities And Equipment

REFER ALSO TO CITATION(S) 7146, 7253, 7254, 7261, 7999, 9063, 9123, 9125, 9127, 9134, 9161, 9165, 9170

8210 **(AD-A—131265/1) Utilization of emerging technologies in physical security systems. phase i--status report--system feasibility. Final report, 1 June-30 November 1980.** Bick, F.A.; Inbar, M.; Cook, F.J.; Kline, F.J. (General Research Corp., Santa Barbara, CA (USA)). 30 Nov 1980. 96p. (GRC-CR—83-1128). NTIS, PC A05/MF A01.

This is a report for the phase I portion of a four phase program. During Phase I, preliminary studies for using disturbed processing networks, adaptive learning networks and fiber optic data links in a fixed site physical security system were completed. A preliminary distributed processing network has been designed upon data requirements at a nuclear weapons storage site, and several hardware alternatives have been identified. This includes both the network node components, and the interconnecting fiber optic links. An example of an adaptive learnilng network was generated using available seismic and acoustic data. This example network has successfully trained to discriminate between personnel footfalls and noise sources such as vehicles, artillery and weather. A receiver operating characteristic (ROC) curve was generated showing the tradeoff between probability of detection and probability of false alarm.

8211 **(ANSI/ANS—8.3-1979) American National Standard: criticality accident alarm system.** (American Nuclear Society, La Grange Park, IL). 10 Oct 1979. 16p. American Nuclear Society, 555 North Kensington Ave., La Grange Park, IL 60525 $16.00.

This standard is applicable to all operations with plutonium, ^{233}U, uranium enriched in ^{235}U, and other fissionable materials in which inadvertent criticality may occur and cause the exposure of personnel to unacceptable amounts of radiation. This standard does not require separate additional instrumentation when the operating instrumentation of facilities, such as nuclear reactors or critical experiments, meets the requirements of this standard. This standard is directed principally toward gamma-radiation rate-sensing systems. Analogous considerations are applicable to integrating systems and to those detecting neutrons.

8212 **(ANSI/ANS—8.6-1983) American National Standard: for safety in conducting subcritical neutron-multiplication measurements in-situ.** (American Nuclear Society, La Grange Park, IL). 16 May 1983. 8p. American Nuclear Society, 555 North Kensington Ave., La Grange Park, IL 60525 $10.00.

This standard provides safety guidance for conducting subcritical neutron-multiplication measurements where physical protection of personnel against the consequences of a criticality accident is not provided. The objectives of in-situ measurements are either to confirm an adequate safety margin or to improve an estimate of such a margin. The first objective may constitute a test of the criticality safety of a design that is based on calculations. The second may effect improved operating conditions by reducing the uncertainty of safety margins and providing guidance to new designs.

8213 **(ANSI/ANS—8.9-1978) American National Standard: nuclear criticality safety guide for pipe intersections containing aqueous solutions of enriched uranyl nitrate.** (American Nuclear Society, La Grange Park, IL). 1978. 10p. American Nuclear Society, 555 North Kensington Avenue, La Grange Park, IL 60525 $15.00.

This Guide provides general criteria and data based on criticality experiments and validated calculations within the scope of this document and simple empirical models, adaptable for engineering purposes for safe design of interconnecting pipe systems handling solutions of uranyl nitrate enriched in the ^{235}U isotope. At present, the only available model is that for aqueous solutions of uranyl nitrate in which the uranium is enriched to 93.5 wt % ^{235}U. As more data become available, models for other uranium isotopic enrichments and fissionable elements may be developed and published as related standards. The Guide is applicable only to the storage and processing of homogeneous aqueous solutions of uranyl nitrate containing the ^{235}U isotope in intersecting pipe geometries. Specific data for U(93.5) are presented, and no consideration is given to mixtures containing other fissionable materials. This Guide does not include specific chemical and mechanical technology, information on fluid dynamics, or other engineering fundamentals also required in safe design of process equipment.

8214 **(ANSI/ANS—8.10-1983-Rev.) American National Standard: criteria for nuclear criticality safety controls in operations with shielding and confinement. Revision.** (American Nuclear Society, La Grange Park, IL). 1983. 12p. American Nuclear Society, 555 North Kensington Ave., La Grange Park, IL 60525 $15.00.

This standard amplifies the conditions necessary for the control of criticality in fissionable materials set forth in American National Standard for Nuclear Criticality Safety in Operations with Fissionable Materials Outside Reactors, ANSI/ANS-8.1-1983. Criteria for the prevention of criticality are presented herein for facilities which provide adequate protection for personnel and the public against radiation and releases of radioactive materials resulting from accidental criticality.

8215 **(ANSI/ANS—8.12-1978) American National Standard: for nuclear criticality control and safety of homogeneous plutonium-uranium fuel mixtures outside reactors.** (American Nuclear Society, La Grange Park, IL). 17 Jul 1978. 18p. American Nuclear Society, 555 North Kensington Ave., La Grange Park, IL 60525 $22.00.

This standard is applicable to operations with homogeneous mixtures of plutonium and uranium. The mixtures may be solutions, suspended solids, precipitates, or may have been formed mechanically. Basic criteria are presented for plutonium-uranium fuel mixtures containing no more than 30 wt. % plutonium combined with uranium containing no more than 0.71 wt. % ^{235}U. This standard does not include the details of administrative controls, the design of processes or equipment, the description of instrumentation for process control, or detailed criteria to be met in transporting fissionable materials. The limits of this standard are not applicable to heterogeneous systems such as lattices of rods in water, mixtures in which particles are large enough to introduce lumping effects, or mixtures in which the concentrations of components are nonuniform. The limits are applicable, however, to homogeneous mixtures and alur-

ries in which the particles constituting the mixture are uniformly distributed and have a diameter no larger than 127 μm (0.005 in.), i.e., are capable of being passed through a 120 mesh screen.

8216 **(BARC—1146) Elasto-plastic analysis of plane stress/plane strain and axisymmetric bodies by FEM.** Dutta, B.K.; Kushwaha, H.S. (Bhabha Atomic Research Centre, Bombay (India)). 1982. 31p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83704145.

The concept of partial thickness method developed by Marcal and King (1967) has been used for elasto-plastic analysis of plane stress/plane strain and axisymmetric bodies by the finite element method. A computer algorithm developed on the above basis has been checked by solving three typical problems, namely, elastic-plastic deformation of: (1) a thick cylindrical shell, (2) a perforated tension strip under inplane loading, and (3) a notched tension strip. The results have been compared with other known solutions/experimental results.

8217 **(HEDL-SA—2915-FP) Secure automated fabrication boat unloading/pellet storage operations.** Neuman, B.H.; Downs, R.E.; Moore, F.W. (Hanford Engineering Development Lab., Richland, WA (USA); Westinghouse Electric Corp., Pittsburgh, PA (USA). Advanced Energy Systems Div.). Oct 1983. Contract AC06-76FF02170. 6p. (CONF-831047—124). NTIS, PC A02/MF A01. Order Number DE84003864.

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

Processing boats of sintered pellets is discussed. Boat unloading, sampling for chemistry analyses, recycling of boats for rework and in-process pellet storage operations are described.

8218 **(IFVE-OEF—82-146) Liquid hydrogen target cooled by circulating helium.** Mel'nik, Yu.M.; Churakov, V.V.; Yakutin, A.E. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1982. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704144.

The structure and characteristics of a liquid hydrogen target, where hydrogen is liquefied with liquid helium flow using evaporation heat of liquid helium and vapour cold, are described. Good thermal insulation of liquid helium supply line permits one to remove from the target the most volumetric and heavy component - the helium tank - and to supply liquid helium along spreaded pipeline from the Dewar helium flask. It results in considerable reduction of dimensions and weight, structure simplification and work facilitation with the target. The target, having a working volume of 400 mm length and 60 mm diameter, was tested. Vacuum casing of the working volume was made of foam plastic, heat flow to the working volume is equal to 1.5 W. Achieving mode of operation including structure cooling and hydrogen liquefaction took approximately 3 h, liquid helium flow rate for liquefaction of 1 l hydrogen is 2.7 l. Liquid helium flow rate in the mode of operation was equal to 0.7 l/h, i.e. target operation period without adding liquid helium to the Dewar flask is 4-5 days. The target described is notable for simplicity in fabrication and reliability in operation and is very suitable for using in experiment as compared to existing targets with hydrogen liquefaction with liquid helium. Unit structure of the target enables one to easily change its configuration relative to problems of concrete physical experiments.

8219 (INIS-mf—8664, pp 39) **Powder metallurgical $CuSnNb_3Sn$ superconductor with incorporated tin.** Eibler, R.; Hilscher, G.; Kirchmayr, H.; Wiesinger, G. (Technische Univ., Vienna (Austria). 2. Inst. fuer Experimentalphysik); GLaetzle, W. (Metallwerk Plansee A.G., Reutte/Tyrol (Austria)). 1982. (In German). NTIS (US Sales Only), PC A05/MF A01. (CONF-8209185—).

From Annual conference of the Austrian Physical Society; Graz, Austria (22 Sep 1982).

8220 (INIS-mf—8664, pp 40) **Powder metallurgical $CuSnNb_3Sn$ superconductor with external tinning.** Eibler, R.; Kirchmayr, H.; Wiesinger, G. (Technische Univ., Vienna (Austria). 2. Inst. fuer Experimentalphysik); GLaetzle, W. (Metallwerk Plansee A.G., Reutte/Tyrol (Austria)). 1982. (In German). NTIS (US Sales Only), PC A05/MF A01. (CONF-8209185—).

From Annual conference of the Austrian Physical Society; Graz, Austria (22 Sep 1982).

8221 (NP—4770030, pp 1111-1133) **New developments on the field of deep drilling technics.** Marx, C. [nd]. (In German). NTIS (US Sales Only), PC A99/MF A01.

In Status report 1982. Geotechnics and deposits. Vol. 2.

Following progresses could be presented within this status report: 1. Important improvements were attained in the field of the development of drilling apparatus in the supplementary equipment for superheavy plants and the handling of the drilling rod. The trend toward super heavy plants is continuing because the depth development of natural gas continues generally successful. 2. In the field of the drilling tools a very fast development started by the use of plate-shaped diamond bits. The initial considerably fluctuating results could be improved in the last two years for medium hard non-abrasive rocks. These tools already have a settled position and they will participate at the total drilling meters in the future even more. 3. Concerning the drilling engines the trend to multi-speed Moineau enpines distinguished more clearly. 4. The core drilling technics has yielded substantial technical improvements in the fields of pressure core pipes and core pipes for soft formations. The system lateral coring is still in the testing phase. 5. The measuring technique while drilling is available in the fields of the determination of the well course. The system with the recording of geophysical, drilling technical, and safety technical measured quantities is used in the fields only in a limited number of devices.

8222 (NP—4770030, pp 1135-1155) **Investigation methods for oil field pipes of large dimension under extreme well conditions.** Marx, C.; Behrens, J. [nd]. (In German). NTIS (US Sales Only), PC A99/MF A01.

In Status report 1982. Geotechnics and deposits. Vol. 2.

In the status report 1982 it is reported about the following working steps in the main points: - Investigation of the loadability of thick-walled oil field pipes - Investigation of the outer pressure strength of oil field pipes - Investigation of the inner pressure strength of oil field pipes - Investigation of the gastightness of oil field pipe fittings.

8223 (NP—4770030, pp 1157-1170) **Working out concepts for drillings, completion and transport problems in unconsolidated heavy oil sands.** Hoefling, B.; Gerhardt, R. [nd]. (In German). NTIS (US Sales Only), PC A99/MF A01.

In Status report 1982. Geotechnics and deposits. Vol. 2.

The development of heavy oil deposits in unconsolidated sands by deflected wells requires better drilling and transport techniques. Within a research project laboratory- and bench-scale investigations were carried out at ITE, Clausthal to select a suitable binding agent mixture for the annulus cementation of thermally stressed wells and of corrosion inhibitors. The new developments in the fields of sand control, auxilliary transportation agents and isolation of pipe bundles were watched by literature studies and evaluation of field experiments.

8224 (NP—4770030, pp 1171-1183) **Moineau-drilling engines for deep wells.** Huesing, R.; Hess, W. [nd]. (In German). NTIS (US Sales Only), PC A99/MF A01.

In Status report 1982. Geotechnics and deposits. Vol. 2.

The aim of the project is the further development of drilling engines which work according to the Moineau principle. The engines should be used as tools in the power drilling in extremely deep wells with a service life of more than 150 hours. The temperature resistance of the engine should amount up to 140°C. By this means it is possible to drill wells economically. The project is grouped to the following partial targets: - Optimization of the dimensioning - Investigation of geometrical and physical variables - Elastomer development - Construction of new conceptions - Devel-

opment of test methods - Erection of prototypes - Laboratory and field testing. The rotor and the stator are generated by the same mathematical function for Moineau geometries. Other geometries which are free from contour failures were investigated. Laboratory and model tests should clear up the influence of the slope, the excentricity, rotor/stator adaptation and the number of speeds on the efficiency. The development of new elastomers should improve the dynamic behaviour and increase the temperature resistance. In connection with this other construction principles like multi-speed systems should be used and tested. It is reported about initial field results.

8225 (NP—4770030, pp 1185-1200) **Wireless data transmission from the borehole and control device for the directional drilling in great depths.** Hense, U. [nd]. (In German). NTIS (US Sales Only), PC A99/MF A01.

In Status report 1982. Geotechnics and deposits. Vol. 2.

A measuring system to determine and to transmit the total course of direction of a well during drilling (MWD=Measurement While Drilling) on the spot shall be developed. Predetermined object circuits shall be reached utmost exactly maintaining the desired course of the well by manipulation from the surface with a dialogue system and by the use of an underground navigation system (Bend-Sub.). Furthermore it should be possible to detect gas outbursts and to lead active safety elements underground.

8226 (PNL-SA—11743) **Advanced cleaning by mass finishing.** McCoy, M.W. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1983. Contract AC06-76RL01830. 14p. (CONF-8311116—1). NTIS, PC A02/MF A01. Order Number DE84004850.

From Deburring and surface conditioning conference; Orlando, FL, USA (7 Nov 1983).

This paper describes a testing program that examined the effectiveness of vibratory finishing for removing a variety of radioactively contaminated soils. The vibratory finishing process was studied by measuring the radiation levels of the test material, the lining of the vibratory finishing tub, and the media. Many soils including corrosion products, scale, oil, grease and paint were removed by the vibratory finishing process. The results of this program indicate that vibratory finishing should be an effective cleaning process for a variety of manufacturing operations.

8227 (RCO—6, pp 305-317) **Magnetometry in pulsed fields.** Groessinger, R. (Techn. Univ. Vienna (Austria). Inst. fuer Experimentalphysik). 1982. NTIS (US Sales Only), PC A99/MF A01. (CONF-8208161—).

From 6. international workshop on rare earth-cobalt permanent magnets and their applications; Baden, Austria (31 Aug 1982).

Different measuring techniques applicable in pulsed fields (inductive, force method, Faraday rotation) are surveyed. The interest is focused on inductive devices where possible pick-up systems in connection with experimental requirements are discussed. The error sources like apparatus inherent troubles, calibration problems and sample inherent effects (eddy currents, time dependence) are described. (Author).

8228 (RCO—6, pp 499-510) **Development of permanent magnet alloys in Japan.** Tawara, Y. (Shinetsu Chemical Co., Takefu, Fukui (Japan)); Kaneko, H. (Soc. of Non-Traditional Technology, Tokyo (Japan)). 1982. NTIS (US Sales Only), PC A99/MF A01. (CONF-8208161—).

From 6. international workshop on rare earth-cobalt permanent magnets and their applications; Baden, Austria (31 Aug 1982).

This report presents the information on the research and development made in regard to magnetic materials recently in Japan. Besides, the report provides actual information on the industrial production. The contents are not only limited to rare earth magnets, but also contain information on the development of new materials such as ferrite magnets, Fe-Cr-Co magnets, Mn-Al magnets etc., and further, forwards the newest information on the rapid-quenching process adopted for the magnetic materials. (Author).

8229 **Installation, checkout and operation of the largest, uniform field, superconducting solenoid magnet.** King, K. (TRW Energy Development Group, One Space Park, Redondo Beach, CA 90278). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics;* **19**: No. 3, 394-397(May 1983). Contract AC03-77ET33006.

TRW's experience in installing, checking out and operating a large superconducting magnet system is described. The magnet is a solenoid 8 meters long, with 1 meter clear bore and 2 Tesla uniform field. It is a central element in a facility designed to support development of the Plasma Separation Process, an advanced technique for uranium enrichment. The emphasis in this paper is on comparisons between expected versus actual behavior and on useful lessons learned. Subjects covered are: system installation and checkout; cooldown; influence of "nonmagnetic" materials on field uniformity; addition of a room temperature trim coil; and problems involving refrigeration capacity and oil contamination in the coldbox.

8230 **Internally cooled cable superconductor (ICCS) for TF and PF coils of FED.** Srivastava, V.; Lubell, M.; Lue, J. (Fusion Engineering Design Center, General Electric Co.). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics;* **19**: No. 3, 398-401(May 1983). Contract W-7405-ENG-26.

Internally Cooled Cable Superconductor (ICCS) concepts developed for TF and PF coils of FED are described. The TF coil conductor design is based on an ICCS successfully used in a small test magnet at ORNL. The conductor consists of triplets of NbTi strands loosely packed in a stainless steel conduit similar to the Westinghouse LCP coil. The operating current for the conductor is 25.5 kA at 10 T and 3.1 K. The conductor is co-wound with a stainless steel C-shaped channel to provide a direct load path to the coil case for the accumulated magnetic loads in the winding. The strand diameter in the conductor is optimized to reduce the eddy current losses. The nuclear heating in the winding is the most dominant heat load. In order to remove these heat loads due to nuclear heating and ac losses in the winding, it is necessary to lower the inlet temperature of helium to 2.2 K. The conductor has a thermal capacity of about 200 mJ/cc, which provides a comfortable stability margin under the operating conditions. The PF conductor is similar to the TF conductor, but it is modified to meet the requirements of the PF coils. For this conductor, the superconducting filament diameter has been reduced and cupro-nickel barrier is provided between adjacent filaments for reducing the hyteresis and coupling ac losses, respectively, under relatively higher pulsed fields. The conductor is designed to carry 21.3 kA at 8 T and 4.5 K.

8231 **Measurements of current noise in dc SQUIDS.** Martinis, J.; Clarke, J. (Dept. of Physics, Univ. of California, Berkeley, CA 94720). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics;* **19**: No. 3, 446-448(May 1983). Contract AC03-76SF00098.

The current noise circulating around the loop of a tunnel junction dc SQUID has been measured as a function of applied flux. The flux noise generated by this current was coupled via a superconducting transformer to a second dc SQUID that was used to measure the noise in a null-balancing configuration. The voltage noise across the SQUID was also measured, using a cooled LCresonant circuit, and the correlation between the voltage and current noises was determined. The measured values of the noises are in good agreement with values obtained from an analog simulator.

8232 **Investigation of 1/f noise in tunnel junction dc SQUIDS.** Koch, R.; Clarke, J.; Goubau, W.; Harlingen; Martinis, J.; Pegrum, C. (Dept. of Physics, University of California, Berkeley, CA 94720). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics;* **19**: No. 3, 449-452(May 1983). Contract AC03-76SF00098.

The authors describe two methods of measuring the 1/f noise in a dc SQUID. One is sensitive only to 1/f noise in the critical currents of the junctions, and the other is sensitive only to 1/f flux noise that is not associated with critical current fluctuations. From measurements on a planar thin-film dc SQUID incorporating Josephson tunnel junctions the authors conclude that the predomi-

nant source of 1/f noise is not noise in the critical currents, but rather an apparent flux noise of unknown origin.

8233 **An analytical investigation of the applicability of simplified ratchetting and creep-fatigue rules to a nozzle-to-sphere geometry.** Gwaltney, R.C. (Oak Ridge National Laboratory, Oak Ridge, TN). *American Society of Mechanical Engineers, Pressure Vessels and Piping Division, [Technical Report] PVP;* PVP-VOL-56: 55-78(1982). (CONF-820601—). Contract W-7405-ENG-26.

From ASME pressure vessel and piping conference; Orlando, FL, USA (27 Jun 1982).

This paper presents an analysis of a nozzle-to-spherical-shell attachment and explores the applicability of simplified ratchetting and creep-fatigue rules to this attachment. A five-cycle inelastic analysis and creep-fatigue damage evaluation was carried out. Ten lines, or critical sections, were chosen for postprocessing to determine the ratchetting strain and creep-fatigue damage at both the inside and outside surfaces. At many of the 20 surface points analyzed, the inelastic analysis results did not develop a constant or decreasing pattern for the incremental strain or damage even after 5 cycles were analyzed. Failure to develop a constant or decreasing pattern was especially prevalent for creep damage. The results of the detailed inelastic analyses at the ten critical sections are compared with the results of elastic evaluations of ratchetting and creep-fatigue damage calculated results of elastic evaluations of ratchetting and creep-fatigue damage calculated according to ASME Boiler and Pressure Vessel Code Case N-47-13. The elastic ratchetting procedures were found to be conservative for all ten sections. The elastically calculated creep damage was nonconservative for two sections. A new technique for simulating a two-dimensional inelastic structure by a series of one-dimensional inelastic membrane shell analyses was also developed.

4203 Lasers

REFER ALSO TO CITATION(S) 8366, 9117

8234 **(AD-A—131156/2) Phase conjugation in a ring laser cavity. Final report, 1 September 1979-31 August 1982.** Diels, J.M. (North Texas State Univ., Denton (USA). Center for Applied Quantum Electronics). 30 Jun 1983. 72p. NTIS, PC A04/MF A01.

We investigate the dynamics of phase conjugation by degenerate four wave mixing (DFWM) inside a laser cavity. This problem is shown to be important in connection with (a) protection of a high power laser against self focusing and (b) development of a new type of laser gyro. Our theory demonstrates that fast optical and temporal phase conjugation by DFWM is incompatible with large (approx. or equal to 1) reflection coefficients. Therefore, it appears to be better to implement DFWM for the coupling of the two counterpropagating pulses in a ring laser, rather than as an end cavity reflection of a linear laser. Various schemes and media were investigated (sodium vapor, amplifier-absorber, jet, saturable absorber thin jet, saturable absorber coupled by evanescent wave). The largest nonlinear third order susceptibility was found in the amplifier jet. Study of fast dynamics of DFWM in an absorber led us to develop a ring laser producing pulses shorter than 55 fs, tunable in a 20 nm range. The measurements of DFWM inside the absorber jet of a ring laser are the basis of a new diagnostic method to measure very short (less than or approximately 100 fs) relaxation rates.

8235 **(AD-A—131628/0) Design and operation of a collective millimeter-wave free-electron laser. Memorandum report.** Jackson, R.H.; Gold, S.H.; Parker, R.K.; Freund, H.P.; Efthimion, P.C. (Naval Research Lab., Washington, DC (USA)). 27 Jul 1983. 40p. (NRL-MR—5076). NTIS, PC A03/MF A01.

A new free-electron laser experiment has been designed at NRL to operate at millimeter wavelengths using a collective beam-wave interaction. Critical features of the experiment include an apertured diode which provides a low emittance electron beam, a wiggler magnet with adiabatic entrance and exit, and an operational domain centered around the wiggler-guide field gyroresonance. With the experiment configured as a superradiant amplifier, the effects of the gyroresonance on beam dynamics and the beamwave interaction have been studied. Measurements indicate a peak power production of 35 MW at 4 mm with an electronic efficiency of 2.5%. Aspects of the experimental design are discussed, and the results of a parametric study of the power dependence on the fields are presented. Detailed calculations (both analytic and computational) have been performed to analyze the linear and nonlinear effects in the experiment. The results of these calculations are shown to be in good agreement with laboratory measurements.

8236 **(AD-P—001528/9) Experimental results of the light-weight hydrogen maser development program.** Peters, H.E. (Sigma Tau Standards Corp., Tuscaloosa, AL (USA)). 1982. 9p. NTIS, PC A02/MF A01.

A research and development program undertaken by Sigma Tau Standards Corporation with the support of the United States Air Force entitled 'Light-Weight Hydrogen Maser' has been completed. Starting from new concepts for a compact cavity maser, the work has progressed from experimental optimization of the bulb and cavity through testing of a breadboard maser to design, construction, and testing of a first operational prototype named the 'Small Hydrogen Maser'.

8237 **(AD-P—001529/7) Characteristics of oscillating compact hydrogen masers.** Wang, H.T.M. (Hughes Research Labs., Malibu, CA (USA)). 1982. 6p. NTIS, PC A02/MF A01.

The design, fabrication and test of the oscillating compact maser, CHYMNS-I, has been previously described. The objective of CHYMNS-1 was to demonstrate that a cavity Q-enhancement technique can be used to obtain sustained maser oscillation in a compact cavity. The superior signal-to-noise ratio of an oscillator and the simplified electronics would facilitate the development of a frequency standard of excellent performance. Obviously, an effective electronic cavity stabilization servo system would be essential to overcome the susceptibility of an external feedback system to environmental perturbations. On the other hand, such a system would provide improved long term maser performance compared to conventional masers where cavity stabilization is based on thermal/mechanical considerations. The objective of CHYMNS-I was successfully accomplished.

8238 **(AD-P—001531/3) Preliminary measurements on EFOS 1 H maser.** Busca, G.; Addor, F.; Hadorn, F.; Nicolas, G.; Prost, L. (Asulab S.A., Neuchatel (Switzerland)). 1982. 6p. NTIS, PC A02/MF A01.

This paper is a progress report on development work a full size active H maser (EFOS 1) presently in progress at ASULAB, NEUCHATEL, in view of an industrial production. The maser design philosophy, the physical package, the receiver and the measurement system are described and preliminary results on the frequency stability, measured by comparison with the prototype masers H1 and H2, are presented.

8239 **(AD-P—001541/2) Frequency stabilization of algaas lasers.** Ohtsu, M.; Tsuchida, H.; Tako, T. (Tokyo Inst. of Tech. (Japan)). 1982. 12p. NTIS, PC A02/MF A01.

Performances of semiconductor lasers have been remarkably improved by the demand of the optical communications industry. Recently, a single longitudinal mode, CW oscillation at room temperature has been realized. The price of each laser has been reduced as low as $250. These lasers are mostly oscillated in the near-infrared, and the coherent lights of 0.83 micrometers and 1.3-1.6 micrometers in wavelengths are obtained by AlGaAs lasers and InGaAsP lasers, respectively. Since few number of other kind of lasers oscillates in these wavelength regions, these semiconductor lasers could be conveniently used not only in optical communications but in many fields of application, e.g., laser spectroscopy, optical pumping, frequency and length standards, laser radar, air-borne gyroscope, etc.

8240 **(AD-P—001542/0) Frequency stability and control characteristics of (GaAl)as semiconductor lasers.** Mooradian, A.; Welford, D. (Massachusetts Inst. of Tech., Lexington (USA). Lincoln Lab.). 1982. 2p. NTIS, PC A02/MF A01.

A study of fundamental linewidth broadening mechanisms in cw (GaAl)As diode lasers is presented. The linewidths were observed to increase linearly with increased reciprocal output power which can be explained using a modified Schawlow-Townes theory. A power-independent broadening of the linewidth was also observed and has been explained as due to refractive index fluctuations resulting from statistical fluctuations in the number of conduction electrons in the small active volume of the devices studied. The range of linewidths for these devices can severely limit the utility of semiconductor lasers in various applications such as frequency standards, heterodyne communications, and fiber optical sensors. Significant performance improvements have been made by operating these devices in a stable external cavity.

8241 **(AD-P—001543/8) Short-term frequency stability and systematic effects on the rubidium by maser oscillator frequency.** Tetu, M.; Tremblay, P.; Bonnier, D.; Vanier, J. (Laval Univ., Quebec City (Canada). Dept. de Genie Electrique). 1982. 8p. NTIS, PC A02/MF A01.

The rubidium maser frequency stability has been measured previously in the time domain for short averaging times and for long averaging times and in the frequency domain. We present in this paper a theoretical evaluation of the possible performance of this type of oscillator taking into account the fact that the maser line is inhomogeneously broadened. Optimum conditions are established on the main maser parameters and the theoretical expression for the short term frequency stability is calculated according to realizable configurations. The systematic effects on the maser frequency were also considered in previous works. We review here these effects adding to their contribution some undiscussed sources.

8242 **(AD-P—001545/3) Spectral characteristics of single mode gaalas semiconductor lasers.** Miles, R.O. (Naval Research Lab., Washington, DC (USA)). 1982. 6p. NTIS, PC A02/MF A01.

Single mode semiconductor lasers are available with free-running noise characteristics comparable to single mode gas lasers but demonstrate a (1/f)(1/2) dependence. The free running laser diode emission is spread over several MHz with significant frequency instability. Small amounts of feedback on the order of 10 to the minus 7th power to 10 to the minus 5th power enhance laser emission as the line is observed to narrow to approximately 100 kHz accompanied with a substantial increase in frequency stability. Greater amounts of feedback causes rapid deterioration of the emission characteristics. We have investigated single mode GaAlAs semiconductor lasers emitting at 830 nm for use as possible sources in fiber optic sensor systems. These lasers have been characterized in terms of spectral quality, intensity noise and frequency stability. A list of the various lasers including laser structure and special features is tabulated.

8243 **(UCRL—52971) High energy laser optics manufacturing: a preliminary study.** Baird, E.D. (Lawrence Livermore National Lab., CA (USA)). Jul 1980. Contract W-7405-ENG-48. 31p. NTIS, PC A03/MF A01. Order Number DE84004740.

This report presents concepts and methods, major conclusions, and major recommendations concerning the fabrication of high energy laser optics (HELO) that are to be machined by the Large Optics Diamond Turning Machine (LODTM) at the Lawrence Livermore National Laboratory (LLNL). Detailed discussions of concepts and methods proposed for metrological operations, polishing of reflective surfaces, mounting of optical components, construction of mirror substrates, and applications of coatings are included.

8244 **Study of the radiation from an undulator: Near field formulation.** Hirai, Y.; Luccio, A.; Yu, L. (National Synchrotron Light Source Department, Brookhaven National Laboratory, Upton, New York 11973). *Journal of Applied Physics;* **55**: No. 1, 25-32(1 Jan 1984).

The spectrum of undulator radiation has been formulated analytically for the near field case and compared with that of the far field case. For an undulator built for the free electron laser experiment in the vacuum ultraviolet storage ring at the National Synchrotron Light Source, it has been calculated that prominent near field effects of the fundamental component could be detected by setting a narrow slit at a specific position on the observation plane off the undulator axis, and the near field effects might disappear within an error of 1% on the undulator axis.

8245 **Collisionless self-focusing of CO_2 10μm P(20) laser light in SF_6.** Ackerhalt, J.R.; Ham, D.O.; Nowak, A.V.; Phipps, C.R. Jr.; Thomas, S.J. (Los Alamos National Laboratory, Los Alamos, NM 87545). *IEEE (Institute of Electrical and Electronics Engineers) Journal of Quantum Electronics;* **QE-19**: No. 6, 1120-1128(Jun 1983).

The authors develop a simple intuitive picture of the vibration-rotation structure of the SF_6 molecule such that the molecular susceptibility responsible for self-focusing can be calculated. They treat the propagation dynamics by generalizing the standard steady-state Gaussian propagation equations to include the important effect of absorption in the wings of the spatial profile. By calibrating the model to absorption data at CO_2 10μm P(20), they find good agreement with beam waist data at the same wavelength. Absorption in the wings is dominant at low laser fluences, and the real part of the susceptibility is responsible for the defocusing-to-focusing turnover in the beam waist near 100mJ/cm^2, consistent with the interpretation of Nowak and Ham (6).

8246 **Short pulse electron beam guns for pulsed laser applications.** Olson, N.T. (Maxwell Laboratories, Inc., San Diego, CA 92123). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 2, 1763-1766(Apr 1981). (CONF-801111—).

From 6. conference on application of accelerators in research and industry; Denton, TX, USA (3 Nov 1980).

Pulsed electron beam guns have been used extensively in high energy, pulsed laser systems. The two applications include direct electron beam pumping of the gain volume and the stabilization of electrical discharge lasers. Electron beam dimensions range from hundreds to thousands of square centimeters. Voltages range from a few hundred kilovolts to a megavolt or more and current densities can range from less than A/cm^2 to a few hundred A/cm^2. Pulse lengths range from tens of nanoseconds to greater than a microsecond. The electron gun diode and pulsed power driver have to be designed for the specific application.

4204 Heat Transfer And Fluid Flow

REFER ALSO TO CITATION(S) 7124, 7555, 8462

8247 **(AAEC/E—556) Improved thermal model for the computer code NAIAD.** Rainbow, M.T. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). Dec 1982. 72p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE83704134.

An improved thermal model, based on the concept of heat slabs, has been incorporated as an option into the thermal hydraulic computer code NAIAD. The heat slabs are one-dimensional thermal conduction models with temperature independent thermal properties which may be internal and/or external to the fluid. Thermal energy may be added to or removed from the fluid via heat slabs and passed across the external boundary of external heat slabs at a rate which is a linear function of the external surface temperatures. The code input for the new option has been restructured to simplify data preparation. A full description of current input requirements is presented.

8248 **(BARC—1147) Laminar forced convective/conductive heat transfer by finite element method.** Kushwaha, H.S.; Kakodkar, A. (Bhabha Atomic Research Centre, Bombay (India)). 1982. 35p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83704135.

The present study is directed at developing a finite element computer program for solution of decoupled convective/conductive heat transfer problems. Penalty function formulation has been used to solve momentum equations and subsequently transient energy equation is solved using modified Crank-Nicolson method.

The optimal upwinding scheme has been employed in energy equation to remove oscillations at high Peclet number.

8249 **(BARC—1148) Finite element computation of natural convection in enclosures.** Kushwaha, H.S. (Bhabha Atomic Research Centre, Bombay (India)). 1982. 21p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704136.

Compared to U-V-P-T formulation and stream-vorticity temperature formulation, penalty function formulation is simple and computationally competitive. Incremental New-Raphons method employed in this study is effective and efficient. From this study it is established that very fine mesh is not required for a low Rayleigh number considered in this study. The upwinding finite element may be necessary to avoid oscillations for higher Rayleigh numbers.

8250 **(DOE/PC/40804—T7) Effects of immersed rod bundles on gross solids circulation in a gas fluidized bed. Special technical report.** Liljegren, J.C. (Illinois Univ., Urbana (USA). Dept. of Mechanical and Industrial Engineering). 1984. Contract FG22-81PC40804. 127p. NTIS, PC A07/MF A01. Order Number DE84004339.

Thesis.

The effect of various rod bundle configurations on the overall pattern of solids circulation in a gas-fluidized bed at both low and high fluidizing velocities was investigated, providing new information on the interaction between internal structures and fluidizing solids. The value of the Computer Aided Particle Tracking Facility for the measurement of solids circulation in gas-fluidized beds has been demonstrated. The facility relies on a radioactive tracer particle manufactured from scandium and having a specific gravity close to that of the glass particles in the fluidized bed. (LEW)

8251 **(EDF—81H406133) Computation of turbulent recirculating flow using curvilinear finite differences. Application of the k - epsilon model to the flow in dredged trenches.** Alfrink, B.J. (Electricite de France, 78 - Chatou). Aug 1981. 100p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE83704137.

The report treats the computation of turbulent recirculating flow in dredged trenches. The mathematical model consists of the full two-dimensional unsteady Reynolds equations, formulated in primitive variables. Turbulence closure is obtained by means of a two-equation (k - epsilon) model. The numerical technique is based on the use of curvilinear finite differences in space and of fractional steps in time. A procedure is proposed to apply the model for varying roughness circumstances. The value of the Von Karman constant can be determined from geometric information. Afterwards, only the c_1-constant is adapted by means of a degenerated epsilon-equation. The report describes an extensive sensitivity study for the inlet conditions and the empirical constants. Ultimately, the results of the mathematical model are very satisfactory. Compared with laboratory experiments, the recirculation length is only underpredicted with 10%.

8252 **(EDF—82H406487) Mean temperature field in rod bundles.** Benque, J.P. (Electricite de France, 78 - Chatou). Jan 1982. 14p. (In French). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704138.

In this report we deal with the equation of the mean temperature field in rod bundles. Using homogenization techniques an equation is given (the simplest) in which an equivalent conductivity tensor appears. This conductivity has not the standard properties: the non symmetric part seems to be important.

8253 **(EDF—82H406614) Some difficulties of the numerical models in fluid mechanics.** Benque, J.P.; Ronat, J. (Electricite de France, 78 - Chatou). Mar 1982. 26p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83704139.

The discretization of advective terms in the numerical models is one of the main difficulties that we have to deal with in fluid mechanics. Different methods are proposed here using a characteristic approach which can be used in finite element discretization. Different examples are given which show the possibilities of the method.

8254 **(FEI—1256) Heat and mass transfer through a transport channel model between a hot gas void and surrounding medium.** Matyushina, S.A.; Opanasenko, A.N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1982. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704140.

Heat and mass transfer through a model of a transport channel between heated gas cavity and environment has been investigated experimentally. An experimental device consisted of 0.2 m^3 cylindrical tank from above connected with an open cylindrical vertical channel d=275 mm having 5-20 d length. Gaseous medium temperature in the tank was maintained constant and could vary from 20 to 400 deg C. Temperature fields, mass transfer depending on geometric characteristics of the channel were investigated, conditions of appearing immovable gaseous plug in the channel were investigated. A mathematical model for calculating fields of temperature and velocity in the channel has been developed. Calculated data obtained coincide quite satisfactorily with experimental data. Detailed temperature and velocity fields can be obtained in a vertical cylinder channel by the technique described.

8255 **(FEI—1278) Effect of a heater size and water subheating on the pool boiling crisis.** Smogalev, I.P. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1982. 7p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704141.

The results of applying the Kolmogorov-Obukhov law of local turbulent diffusion and the Kutateladze hydrodynamic model to derivation of a formula for estimation of critical thermal fluxes in a bulk volume are presented. Considered is also the effect of a heater size and of liquid underheating on the critical thermal flux. The analytical relationships obtained are compared to the experimental data on critical thermal fluxes at water boiling.

8256 **(FEI—1330) Determination of evaporating flux in annular dispersed flow on the base of a numerical experiment.** Kashcheev, V.M.; Muranov, Yu.V.; Yur'ev, Yu.S. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1982. 18p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704142.

Heat flows removed with evaporating drops on a tube wall in the posterisis zone have been calculated by the TM-DISKO program developed on the basis of an earlier developed, two-dimensional mathematical model of annular-dispersed and two-phase dispersed flows. The calculations were performed for a uniformly heated tube of 16x2.5 mm diameter at P=9.8-13.7 MPa, mass velocities rhow=500-2000 kg/(m^2s) and enthalpies at the input Jsub(in)=1250-1670 kJ/kg. The calculational results showed: 1) considerable contribution of evaporation flows to heat removal in the posterisis zone, especially at high mass velocities and pressures; 2) that it is possible to construct the following scheme of heat removal: total received heat Qsub(epsilon) is removed in the quantity Qsub(ev) with drop evaporation with heat transfer coefficient αsub(ev) and in the quantity (I-Qsub(ev1) - with convection with heat transfer coefficient αsub(con).

8257 **(FEI—1351) Technique for temperature calculation in fuel element clusters taking into account interchannel heat transfer.** Dvortsova, L.I.; Kumaev, V.Ya.; Leonchuk, M.P.; Slyunyaev, N.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1982. 11p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704143.

Techniques are considered for the temperature calculations in fuel element clusters, taking into account heat transfer due to thermal conductivity and due to coolant mixing caused by the fuel element helical ribs. The techniques are based on solving the equations of thermal equilibrium of groups of fuel elements and cells filled with the coolant, the groups being schematically divided to surround the clusters by grids related to the fuel element centers. The equilibrium equations are solved by both numerically explicit

and inexplicit differential methods. The temperature calculation methods considered are mainly intended to be used for large fuel element clusters of both homogeneous and inhomogeneous structure.

8258 **(SFB—80/T/222) Eulerian and lagrangian predictions of particulate two-phase flows.** Durst, F.; Milojevic, D.; Schoenung, B. (Karlsruhe Univ. (T.H.) (Germany, F.R.). Sonderforschungsbereich Ausbreitungs- und Transportvorgaenge in Stroemungen). Apr 1983. 43p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE84750050.

To predict particulate two-phase flows, two different approaches are possible. One which treats the fluid phase as a continuum and the particulate second phase as single particles. This approach which predicts the particle trajectories in the fluid phase as a result of forces acting on particles, is called the lagrangian approach. Treating the solid as some kind of continuum and solving the appropriate continuum equations for the fluid phase and the particle phase, is refered to as the eulerian approach. In the present report, both approaches are discussed and their basic equations for the particle and fluid phase as well as their numerical treatment are presented. Particular attention is given to the interactions between both phases and their mathematical formulation. The resulting computer codes for the lagrangian approach and the eulerian approach are briefly discussed and their application to predictions of particulate two-phase flows described. The authors have carried out predictions for various test cases using both the eulerian and the lagrangian approach. In the present report, the following cases are presented in details: a) Vertical pipe flow at various particle concentrations and b) Sudden expansion in a vertical pipe flow.

8259 **Free convection in a vertical annulus with constant heat flux on the inner wall.** Keyhani, M.; Kulacki, F.A.; Christensen, R.N. (Department of Mechanical Engineering, The Ohio State University, Colulmbus, Ohio 43210). *Journal of Heat Transfer;* **105**: No. 3, 454-550(Aug 1983).

Heat transfer measurements are presented for free convection in a vertical annulus wherein the inner cylinder is at constant surface heat flux and the outer cylinder is at constant temperatuare. Overall heat transfer data re corrected for thermal radiation in the annulus. Rayleigh numbers span the conduction, transition and boundary layer regimes of flow, and average heat transfer coefficients are obtained with air and helium as the working fluids. The range of Rayleigh number is $10^3 < Ra < 2.3 \times 10^6$; the radius ratio is 4.33; and the aspect ratio (cylinder length divided by annular gap) is 27.6. Energy transferred by thermal radiation varies with Rayleigh number and working fluid. With air, thermal radiation can account for up to 50 percent of the heat transfer. With helium, radiation can account for up to 30 percent of the heat transfer rate. The results of the study provide data relevant to the design and performance assessment of spent fuel packages as part of the National Waste Terminal Storage Program for nuclear waste isolation.

8260 **Experiments on a crossing heat exchange with tubes of lenticular shape.** Ruth, E.K. (California Institute of Technology, Pasadena, California). *Journal of Heat Transfer;* **105**: No. 3, 571-617(Aug 1983).

Measurements of pressure losses and heat transfer rates were made for an unconventional crosaflow heat exchanger with tubes of lenticular cross section so spaced to reduce variation in the velocity of the fluid outside the tubes, thus reducing separation and drag. The results of these experiments are reported for various tube spacing and demonstrate that the performance of the lenticular tube heat exchanger is superior to that of conventional circular tubes by 20 percent at Reynolds numbers of 20,000 to 50,000.

4205 Materials Testing

REFER ALSO TO CITATION(S) 7561, 7562, 7617, 7743, 7872, 8222

8261 **(INIS-mf—8234) Determination of corrective factors for an ultrasonic flow measuring method in pipes accounting for perturbations.** Etter, S. (Stuttgart Univ. (Germany, F.R.). Fakultaet Energietechnik). 27 May 1982. 149p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE83703961.

By current ultrasonic flow measuring equipment (UFME) the mean velocity is measured for one or two measuring paths. This mean velocity is not equal to the velocity averaged over the flow cross-section, by means of which the flow rate is calculated. This difference will be found already for axially symmetrical, fully developed velocity profiles and, to a larger extent, for disturbed profiles varying in flow direction and for nonsteady flow. Corrective factors are defined for steady and nonsteady flows. These factors can be derived from the flow profiles within the UFME. By mathematical simulation of the entrainment effect the influence of cross and swirl flows on various ultrasonic measuring methods is studied. The applied UFME with crossed measuring paths is shown to be largely independent of cross and swirl flows. For evaluation in a computer of velocity network measurements in circular cross-sections the equations for interpolation and integration are derived. Results of the mathematical method are the isotach profile, the flow rate and, for fully developed flow, directly the corrective factor. In the experimental part corrective factors are determined in nonsteady flow in a measuring plane before and in form measuring planes behind a perturbation.

8262 **(LA-UR—83-3278) Frictional hot-spots and statistical crack mechanics.** Dienes, J.K. (Los Alamos National Lab., NM (USA)). 1983. Contract W-7405-ENG-36. 10p. (CONF-831174—42). NTIS, PC A02/MF A01. Order Number DE84003784.

From Materials Research Society annual meeting; Boston, MA, USA (14 Nov 1983).

When propellant cylinders are fired at low speeds against a steel plate, detonations are often observed. Since the process is not repeatable, and shock heating is not significant, it is natural to consider the possibility of detonation caused by hot spots. Several mechanisms are compared, and it is suggested that interfacial friction of closed cracks seems to be the most likely mechanism. 24 references.

8263 **(PB—83-239574) (nondestructive evaluation) publications: 1981.** Mordfin, L. (National Bureau of Standards, Washington, DC (USA). Radiation Physics Div.). Jul 1983. 47p. (NBSIR—83-2741). NTIS, PC A03/MF A01.

This is the fifth in a series of bibliographies of NBS publications on nondestructive evaluation (NDE). It provides bibliographic citations, with selected abstracts, for 172 publications that appeared in the open literature, primarily during calendar year 1981. A detailed subject index is included as well as information on how copies of many of the publications may be obtained.

8264 **Reconstruction of inclusions in solids using ultrasonic Born inversion.** Hsu, D.K.; Rose, J.H.; Thompson, D.O. (Ames Laboratory, USDOE, Iowa State University, Ames, Iowa 50011). *Journal of Applied Physics;* **55**: No. 1, 162-168(1 Jan 1984). Contract W-7405-ENG-82.

Voids and inclusions in elastic solids are characterized experimentally using scattered ultrasonic waves. The flaws are reconstructed using a one-dimensional elastic wave inverse scattering algorithm based on the Born—Neuman expansion. This method emphasizes the role of low and intermediate frequency longitudinal waves. The utility of the inverse Born approximation is tested for several new circumstances. First the algorithm is tested for pitch-catch (bistatic) geometries. Secondly the effects of resonant excitation of the scatterer on flaw characterization are measured for several spherical flaws. The third and major result shows that the one-dimensional algorithm can be used to determine the size, shape and orientation of nearly ellipsoidal flaws when access angle is limited. The effects of varying access aperture on the reconstruction are reported. Another common experimental limitation in flaw characterization arises from interferences of the flaw signal with nearby surfaces. We briefly report that the same algorithm was successful in inverting several near surface flaws. In particular, we have successfully reconstructed, in the bulk of the sample, an approximately prolate spheroidal inclusion imbedded in plastic, an oblate spheroidal void in titanium, and in the near surface region an approximately prolate spheroidal inclusion.

8265 **Bulk elemental analysis by the inelastic scattering of neutrons produced with a Van de Graff accelerator.** Barfoot, K.M.; Cheng, C.W.; MacArthur, J.D.; Robertson, B.C.; Saha, S.K.; Wilson, K.M. (Queen's Univ., Kingston, Ontario K7L 3N6). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-28: No. 2, 1644-1646(May 1983). (CONF-801111—).

From 6. conference on application of accelerators in research and industry; Denton, TX, USA (3 Nov 1980).

Bulk multi-elemental analysis by inelastic neutron scattering with the detection of prompt gamma rays may become an invaluable tool for the non-destructive analysis of rare objects. Various neutron-producing reactions initiated by Van de Graff charged particle beams have been compared for their suitability in multi-elemental analysis. It is concluded that, of the reactions investigated, the $^{13}C(\alpha,n)^{16}O$ reaction at E /SUB ln/ = 3.5 MeV is the most useful for the present applications. Preliminary minimum detection limits are given for fifteen elements.

8266 **Time domain Born approximation.** Rose, J.H.; Richardson, J.M. (Ames Laboratory, USDOE, Iowa State Univ., Ames, Iowa 50011). *Journal of Nondestructive Evaluation;* 3: No. 1, 45-53(Mar 1982). Contract W-7405-ENG-82.

The time domain Born approximation for ultrasonic scattering from volume flaws in an elastic medium is described. Results are given both for the direct and the inverse problem. The time domain picture leads to simple intuitive formulas, which we illustrate by means of several simple examples. Particular emphasis is given to the front surface echo and its use in reconstructing the properties of the flaw.

8267 **Quantitative use of Rayleigh waves to locate and size subsurface holes.** Zachary, L.W. (Ames Laboratory-USDOE, Iowa State University, Ames, Iowa 50011). *Journal of Nondestructive Evaluation;* 3: No. 1, 55-63(Mar 1982). Contract W-7405-ENG-82.

An ultrasonic inspection method is used to obtain the circumference of a subsurface hole and the depth of the hole below the surface. A pitch-catch Rayleigh wave transducer set-up was used to launch a Rayleigh surface wave at the flaw and to capture and record the scattered waves. The frequency spectrum of the scattered waves can be used to obtain the depth of the hole. The ligament of material between the hole and the surface is sent into resonance, and this feature can be extracted from the scattered waves' frequency spectrum. The frequency is a function of the ligament length; thus the hole depth can be obtained. The circumference of the hole is found from a time of flight measurement. A Rayleigh wave is formed that travels around the hole's surface. The length of time required for the wave to travel around the hole is a measure of the circumference.

8268 **Application of metal wedges to wave propagation.** Fisher, E.S.; Henkleman, G.; Smith, B.; Van Hook, D.; Zwick, D. (Materials Technology Corp., Sarasota, Florida). *Journal of Nondestructive Evaluation;* 2: No. 3/4, 231-239(Dec 1981).

Techniques for propagating Rayleigh waves with frequencies varying from <1 to 270 MHz were developed for the purpose of nondestructive evaluation of composition or defect gradients near the surface of nonpiezoelectric solids. The surface waves with frequencies greater than 15 MHz were obtained from a novel technique using single crystal wedges, whereas the low frequency waves were produced by a previously used high voltage impulse. Measurements of Rayleigh wave velocities on single crystals of Ge and Al were performed as a test of accuracy and precision and are compared with calculated values.

4206 Safety Engineering

REFER ALSO TO CITATION(S) 7211, 7212

4208 Electronic Circuits And Devices

REFER ALSO TO CITATION(S) 8073, 8365, 8493

8269 **(AD-A—131255/2) Supplemental grounding of extended emp collectors. Final report, 1 May 1980-31 January 1982.** Denny, H.W.; Acree, D.W.; Melson, G.B.; Millard, D.P. (Georgia Inst. of Tech., Atlanta (USA). Energy and Material Sciences Lab.). 31 Jan 1982. 180p. NTIS, PC A09/MF A01.

The external conductors of a facility, particularly long, above ground types, pose a severe EMP threat. A primary purpose of this program was to investigate the premise that supplemental ground connections in these types of conductors could serve to reduce this threat. To support this investigation an External Collector Analysis Model (ECAM) was developed. ECAM was applied to analyzing the EMP-induced current levels appearing at a facility under various conditions of line length, line height, and number of grounds. From the results, approaches to the treatment of external collector penetrations are suggested. In addition to the external collector assessments, preliminary studies of internal collector responses are reported. Supplemental studies of techniques for measuring the responses of earth electrode systems over the EMP power spectrum are described. A successful technique utilizing currently available instrumentation was used to validate a test probe and to evaluate scaled models of various commonly used earth electrode geometries. From the measurements, observations relating to the behavior of various geometries up to 500 MHz are made.

8270 **(AD-P—001561/0) Update on the tactical miniature crystal oscillator program.** Jackson, H.W. (Bendix Corp., Baltimore, MD (USA). Communications Div.). 1982. 7p. NTIS, PC A02/MF A01.

The Tactical Miniature Crystal Oscillator (TMXO) and its more significant design features have been described previously. In this paper, the performance characteristics of the early TMXO models will be presented. In addition, performance results representative of more recent units which use SC-cut crystals are included and mechanical changes to improve the internal structural characteristics are discussed. Finally, a test oscillator useful in evaluating crystals is described.

8271 **(DOE/AL/04047—T12) High voltage, low inductance hydrogen thyratron study program. Phase V. Final report, 1 April 1982-31 December 1982.** Friedman, S. (EG and G, Inc., Salem, MA (USA)). Aug 1983. Contract AC04-77AL04047. 30p. NTIS, PC A03/MF A01. Order Number DE84000627.

50 kv per-stage dynamic breakdown voltage (DBV) has been demonstrated in low inductance multi-stage hydrogen thyratrons for total voltages up to nearly 200 kv, at pressures consistent with a 10 ns current rise time. High peak current operation has been demonstrated up to 14 ka at 56 kv (the limits of our high current test kit). Bottom-stage holdoff and per-stage DBV are comparable to that of the best single-stage thyratrons (i.e., bottom-stage holdoff, stage voltage addition, and prefire problems have been solved).

8272 **(LA—9843-MS) Shaping of current pulses by a transmission line.** Suydam, B.R. (Los Alamos National Lab., NM (USA)). Oct 1983. Contract W-7405-ENG-36. 26p. NTIS, PC A03/MF A01. Order Number DE84004477.

We examine here how group velocity dispersion, and also how nonlinearity of a transmission line, can be exploited to achieve pulse compression and wave front steepening, producing a rapidly rising current. A possible design for a nonlinear line is presented.

8273 **Profile control of polysilicon lines with an SF_6/O_2 plasma etch process.** Light, R.W.; Bell, H.B. (Sandia National Laboratories, Albuquerque, NM). *Journal of the Electrochemical Society;* 130: No. 7, 1567-1571(Jul 1983). Contract AC04-76DP00789.

Typical plasma etching techniques used in integrated circuit fabrication can generate steep topographies that cannot be covered adequately by subsequent deposition steps. An SF_6/O_2 plasma etching process for polysilicon using controlled photoresist erosion produces tapered edge profiles compatible with step coverage requirements. The degree of taper is a function of the photoresist profile, the photoresist to polysilicon etch rate ratio, and the extent of overetch. The photoresist and the polysilicon appear to etch predominantly anisotropically with the isotropic component of the polysilicon etch rate increasing during the overetch period.

8274 **The prevention of latchup in microcircuits using proton beams.** Eddy, J.K.; Bartko, J. (Indiana University of Pennsylvania, Indiana, PA). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-28: No. 2, 1871-74(Apr 1981). (CONF-801111—).

From 6. conference on application of accelerators in research and industry; Denton, TX, USA (3 Nov 1980).

Electronic devices, subjected to bursts of ionizing radiation and voltage spikes, can latchup resulting in device destruction. Several methods have been proposed and utilized effectively for latchup prevention. In this paper the authors discuss a method, involving irradiation of the devices with protons, which offers several advantages over other methods.

4210 Combustion Systems

REFER ALSO TO CITATION(S) 7171, 7338, 7339, 7340, 7341, 7342, 7344, 7345

8275 (CONF-830381—, pp 9-22) **Ranking of home heating systems using calorimeter houses: system net efficiencies and fuel cost per delivered Btu.** Barnett, S. (Condar Co., Hiram, OH). Aug 1983. NTIS, PC A10/MF A01.

From Solid fuel heat technology symposium; Baltimore, MD, USA (11 Mar 1983).

This report supplies homeowners with comparative data with which to evaluate the net delivered efficiencies and costs per delivered Btu of various heating systems. Calorimeter houses located in northeastern US were used to test electric resistance heating, heat pumps, free standing wood stoves, catalytic wood stoves, kerosene space heaters, central oil furnaces, natural gas furnaces, and central wood furnaces. This testing also yielded heat loss measurements and this data is also tabulated. Kerosene space heaters were shown to be the most efficient, followed closely by the advanced catalytic wood stoves. Wood heat was the least expensive; electric heat, the most expensive. 3 figures, 2 tables. (CKK)

8276 (CONF-830381—, pp 156-193) **Investigation of the effects of ambient temperatures and forced convection on radiant stove efficiency.** Shelton, J.W.; Graeser, L. (Shelton Energy Research, Santa Fe, NM). Aug 1983. NTIS, PC A10/MF A01.

From Solid fuel heat technology symposium; Baltimore, MD, USA (11 Mar 1983).

The Wood Heating Alliance has coordinated an effort to create and improve standard methods of measuring energy efficiencies of residential solid fuel heaters. Variables which affect the efficiency include the fuel, the installation, test environment details, operation of the appliances, and the performance measurement techniques. The objective of the study reported in this paper was to provide data on two test environment parameters, ambient temperature and ambient air velocity, to determine their probable effects on efficiencies of radiant heaters to allow specification of acceptable ranges of the parameters. The experimental datails are described fully. It was found that heat transfer efficiency was not influenced by ambient temperatures between 12° and 30°C within the +- 0.5% precision, so there is no reason to tighten the current standard of ambient temperatures (70° to 90°F). It was also found that forced convection resulting from a velocity of about 65 ft/min was required to have an effect of 0.5% on the stove's heat transfer efficiency. The current standard of 20 ft/min within 2 ft of the appliance should be relaxed if the standard is difficult to obtain in the laboratory. If not difficult to obtain, the authors recommend maintaining the current standard as the appropriately conservative course. 1 reference, 12 figures, 5 tables. (CKK)

8277 **(DFVLR-MITT—83-01) New combustion system for burning light distillate fuel oil.** Eickhoff, H. (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt e.V., Koeln (Germany, F.R.)). 1983. 19p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750052.

A contrallable small burner unit was developed which works well in the power range necessary for an optimum operation with regard to the overall efficiency of a residential heating system. The pollutant emissions, CO as well as NOsub(x), are low. Due to the nature of the system the air pressure drop is far above that of conventional domestic burners. Present development of the combustion system is mainly directed towards a reduction of the air pressure drop and the amount of excess air.

8278 **(DOE/ET/10480—T1) Heat transfer in high temperature fluidized beds with immersed tubes for coal combustion service. Final report, October 1, 1977-March 31, 1981.** Welty, J.R. (Oregon State Univ., Corvallis (USA)). [nd]. Contract AS21-77ET10480. 149p. NTIS, PC A07/MF A01. Order Number DE83017456.

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The project involved two parts: analytical and experimental. The progression of work includes the following major divisions: analytical studies involving studies of heat transfer, hydrodynamics of gas flow within the bed, and some considerations of bubble and adjacent tube influences on the heat transfer; experimental apparatus including the instrumented tubes for heat transfer measurements, digital data acquisition, and the high temperature fluidized bed test facility; experimental results; and experimental validation of the analytical model.

8279 **(DOE/MC/20334—T1) Study of deposition control using transpiration. Monthly technical progress report for December 1983.** (Massachusetts Inst. of Tech., Cambridge (USA)). Dec 1983. Contract AC21-83MC20334. 11p. NTIS, PC A02/MF A01. Order Number DE84005020.

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The purpose of this project is to determine the conditions under which transpiration may be actually used to avoid deposition of small particles. The application of this work is the control of the deposition of small particles over a surface kept at a temperature below the melting point of compounds likely to exist in the combustion products. A combined experimental and theoretical research program will be carried out to evaluate the concept of transpiration as a deposition control strategy. A first order theory will be refined by introducing an appropriate turbulence model. The experimental program is designed to evaluate and refine the theoretical model under conditions which provide the correct Reynolds and Stokes numbers. The experimental set up consists of a wind tunnel with a test containing a flat porous transpired section. The measurements will determine the distribution of velocity and of particles concentration in the boundary layer. The experiments will be conducted for different particles sizes under conditions simulating gas turbine conditions. There are two main tasks, one experimental and second theoretical to evaluate the concept of transpiration as a particle deposition control. The sub-task of the experimental section over the design and construction of the experimental facility, the design, assembly and calibration of the instruments. The collection of data for the reference case and for other sizes. Other sub-tasks are the data analysis and report preparation. The plan for this month was the test of the gravity particle feeder system, and the initiation of the design of the coolant injection system and of the laser beam positioning system. In addition, the literature search and survey were to be pursued.

8280 **(DOE/PC/40269—22) Combustion characteristics of fine-ground coal. Final report, March 1, 1981-August 31, 1982.** Briceland, C.L.; Khinkis, M.J.; Waibel, R.T. (Institute of Gas Technology, Chicago, IL (USA)). Oct 1983. Contract AC22-81PC40269. 102p. NTIS, PC A06/MF A01. Order Number DE84003748.

The objective of this project was to experimentally determine the effect of coal particle size on pulverized coal flame characteristics for boiler application. Specifically, flame characteristics such as flame temperatures, radiant heat transfer and overall heat transfer to the furnace load, specific heat release density and NO/ sub x/ emissions, and the effect on fly ash slagging and fouling tendencies were determined at the high furnace combustion gas temperatures typical of boilers designed for natural gas and oil firing.

4220 Underground Engineering

REFER ALSO TO CITATION(S) 7149, 8661, 8662

8281 **(NP—3770165) Mechanising the development work of headings by blasting.** Stoecker, H.M. (Technische Univ. Clausthal, Clausthal-Zellerfeld (Germany, F.R.). Fakultaet fuer Bergbau, Huettenwesen und Maschinenwesen). 6 Feb 1981. 150p. (In German). NTIS (US Sales Only), PC A07/ MF A01. Order Number DE83770165.

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Based on the analysis of use of development aids and the situation in drifting operation as it was so far some requirements for a development aid system were set up, standardised and rated. These requirements lead to the design of a development system which keeps the conventional forepoling and consists of a floor-connected transport and erection vehicle. A solution concept was developed the main part of which is the development aid system; this concept was set up for a representative drift, which is represented by a coal road into which a four-part sliding roadway arch with a clear section of 18,5 m^2 at a clear interval of 0,80 m is installed. In addition to the side-tipping loader a new drilling installation which is guided in the roof is considered as the mechanisation of the development work and the simultaneous course important of different work processes are equally important. An estimate of performance calculated at four thirds of the drift with 6 men each showed that the drift speed was maximally 9,60 m/d, this is valid for 2,40 m of advance per round in cyclic operation and for 3,20 m of advance per round in non-cyclic operation. In order to find out whether this can be realized with regard construction and organisation a model of the driving equipement was built on a scaleof 1:5, the model is true to real dimensions and forces. The development aid system has a mechanised face support and can therefore be mechanised to a greater extent than other development aids. Furthermore the support phases - as for example the preliminary erecting of the support - are integrated into the time schedule od driving cycle that other work processes are hardly influenced at all. Other processes which are not related to the driving process are even supported by the transport and erection vehicle.

8282 (NP—4770030, pp 561-566) **Explosion-proof television camera to record the seams and their counterrocks and tectonic areas in underground wells.** Brenken, W. [nd]. (In German). NTIS (US Sales Only), PC A99/MF A01.

In Status report 1982. Geotechnics and deoposits. Vol. 2.

The fall-outs of the television cameras to record the seams in underground wells increased due to the rough underground transport conditions. For the general cushioning of the hard shocks a transport vessel with special rubber bonded mounting has been built for the transport of the television camera. In order to observe large diameter wells with diameters of 120 to 1400 mm an axial control and lighting front structure with a removeable lense has been developed. The form and extent of the well deformation could be very well estimated in an underground test run.

4230 Marine Engineering

8283 **(EFI-TR—2856) Plastic insulation at offshore installations. Choise of conducting and insulating materials.** Herstad, K.; Sletbak, J. (Elektrisitetsforsyningens Forskningsinstitutt, Trondheim-NTH (Norway)). Apr 1982. 32p. (In Norwegian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84750118.

The report describes various degradation mechanisms for electrical conducting and insulating materials in a marine environment. Corrosion is the main problem for conductors. Protecting against humidity, which is difficult, is the only solution. A good practical way is to cover metal parts with special grease. Today plastics dominate as insulators. Many of them undergo changes in contact with oil spills, when exposed to ultra violet radiation and due to cracking. Two cracking test schemes are described. A survey of the properties of the main plastic materials in resisting strains is given. The correct choice of an insulator will depend on the physical properties of the material. 1 table, 5 figures.

4240 Pollution Control Equipment

REFER ALSO TO CITATION(S) 7133, 7137, 8505

8284 **(ANL/FE—82-11) Particulate removal from high-temperature, high-pressure combustion gases.** Henry, R.F.; Saxena, S.C.; Podolski, W.F. (Argonne National Lab., IL (USA)). Oct 1983. Contract W-31-109-ENG-38. 119p. NTIS, PC A06/MF A01. Order Number DE84004194.

The adoption by utilities of coal-fired pressurized fluidized-bed/combined cycle combustion systems for electric power generation depends to a large extent on the development of an efficient and economic cleanup system for the high-temperature, high-pressure combustion gases. For adequate turbine protection, these gases must be sufficiently cleaned to bring particulate erosion and alkali vapor corrosion to a level acceptable to gas turbine manufacturers. At the same time, the total particulate content of the flue gas must be reduced to the limit set by the Environmental Protection Agency. To accomplish particulate removal from a dust-laden gas stream, a number of separation devices have been developed. These include conventional and augmented cyclones; porous metal, fiber, fabric, and ceramic filters, as well as fixed, moving, and fluidized-bed granular filters; and electrostatic precipitators. Several other novel separation devices have been proposed and developed to different degrees such as: contactors using molten salt, metal, or glass, dry scrubbers, acoustic agglomerators, as well as cyclones and granular-bed filters with external electrostatic or magnetic fields. Some of these separation devices in various combinations have been tested in process development units or in hot gas simulators by ANL, CPC, CURL, C-W, Exxon, GE, Westinghouse, etc. The results are discussed and evaluated for PFBC applications.

8285 **(IKE—7-6) Ventilation of the surface treatment zone in carpenter's shop.** Dittes, W. (Stuttgart Univ. (Germany, F.R.). Inst. fuer Kernenergetik und Energiesysteme). Jan 1983. 79p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84750054.

Contaminants are emitted, when furniture is varnished and dried in carpenter's shops. These contaminants should be directly removed - if possible - at the location, where they are generated. Furthermore the rooms have to be ventilated to keep the contaminant concentration under the level tolerable for the occupied persons. A ventilation system, which should minimize air flow and energy input, is designed and tested in a small scale model. The contaminant distribution is measured by tracer gas technique.

8286 (INIS-mf—8584, pp 40) **Instrumentation for iodine filter testing.** Tomasek, M. (Ceskoslovenska Akademie Ved, Prague. Ustav Dozimetrie Zareni); Zelinka, T. (Vyzkumny Ustav Vodohospodarsky, Prague (Czechoslovakia)). [nd]. (In Czech). NTIS (US Sales Only), PC A09/MF A01. (CONF-8105231—).

From Conference on nucleonic instruments and their use in the CSSR; Pribram, Czechoslovakia (18 May 1981).

Published in summary form only.

4250 Power Cycles

REFER ALSO TO CITATION(S) 7227, 8205

43 PARTICLE ACCELERATORS

4301 Design, Development, And Operation

REFER ALSO TO CITATION(S) 7303, 8009, 8142, 8315, 8832, 8836

8287 **(FERMILAB/TM—1141) Tevatron I: Large Bore Quad lamination analysis.** Leininger, M. (Fermi National Accelerator Lab., Batavia, IL (USA)). 26 Oct 1982. Contract AC02-76CH03000. 5p. NTIS, PC A02/MF A01. Order Number DE84003588.

Stacking, compression, and welding of the laminations for the TeV I Large Bore Quad results in a deformation due to springback which is unacceptable due to magnetic field requirements. ANSYS has been used to analyze a solution to this problem.

8288 **(FERMILAB/TM—1143) Design considerations for the Fermilab test RFQ.** Neuffer, D. (Fermi National Accelerator Lab., Batavia, IL (USA)). Oct 1982. Contract AC02-76CH03000. 17p. NTIS, PC A02/MF A01. Order Number DE83015734.

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A new concept in low energy proton/ion accelerators is being developed at accelerator facilities throughout the world. This concept is labeled the RFQ linac (Radio-Frequency Quadrupole) and was first proposed by Kapchinskii and Teplyakov and more extensively developed by scientists at Los Alamos, where precise design procedures are being developed and a proof of principle experiment was performed. RFQ design and construction is currently being undertaken by groups at almost every major laboratory in the world (CERN, BNL, LASL, GSI, LBL, INS, Saclay, etc.). We propose that Fermilab also participate in this development, to gain local knowledge in this new technology and also to improve the low energy portion of the Fermilab linac. In this note we review current progress in RFQ design concepts and outline design parameters for a Fermilab RFQ. Our first RFQ is planned to be a 200 MHz structure accelerating H^- from $\sim$ 30 keV (source energy) to 750 keV, and is a possible replacement for the Cockcroft-Walton, as well as a development project.

8289 **(IFVE-OMVT—82-92) MULTIMODE program package for calculation of the frequency spectra for axially symmetric and longitudinally homogeneous electromagnetic resonators by the finite element method.** Kaschieva, V.A.; Kaschiev, M.S.; Kochin, V.N.; Fedoseev, A.I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1982. 23p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704147.

The MULTIMODE set of programs intended for calculations of the eigenfrequency spectra and electromagentic fields for plane and axially symmetric resonators is described. Manuals for handling with the programs at the ICL-1906A computer are given. The results of calculating the parameters of the electron linac accelerating system initial part are considered as an example. The eight node quadrangular isoparametric elements are used for calculations. This gives the opportunity to approximate curvilinear boundaries using relalively small number of nodes and provides high calculational accuracy. The structure of the programs does not impose any restrictions on the size and configuration of a resonator under study. The programs are written in the FORTRAN-4 language and can be easily adapted for the ES computers. On the base of the comparison of the calculational results obtained by means of different programs the conclusion is drawn that the time of calculation for the MULTIMODE programs is by 1-2 orders smaller.

8290 (KFTI—81-52, pp 3-4) **Development of electron linear accelerator with standing wave and beam circulation at the 10 MeV energy.** Zavadtsev, A.A.; Zverev, B.V.; Sobenin, N.P. (Moskovskij Inzhenerno-Fizicheskij Inst. (USSR)). 1981. (In Russian). NTIS (US Sales Only), PC A05/MF A01. (CONF-8106218—No.3(9)).

From 7. all-union seminar on linear accelerators; Kharkov, Ukrainian SSR (2 Jun 1981).

Results of investigations into development of an electron linac with a standing wave and 10 MeV beam circulation power supplied from 1.5 MW series magnetron are stated. Considered were problems of choice of a principal accelerator flowsheet, choice and modelling of biperiodical moderating structure, substantiation and calculation of SH power supply circuit through directed decoupling, determination of limiting rate of energy accumulation and rational arrangement of all the accelerator systems. Preliminary results show that development of such class devices is quite real and perspective.

8291 (KFTI—81-52, pp 5-7) **Parts of the RF power input system in linear accelerator used as injector in booster.** Mazurov, E.V.; Mal'tsev, I.G.; Shalashov, I.M. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1981. (In Russian). NTIS (US Sales Only), PC A05/MF A01. (CONF-8106218—No.3(9)).

From 7. all-union seminar on linear accelerators; Kharkov, Ukrainian SSR (2 Jun 1981).

Data on peculiarities of element structures of a HF power introduction system into a linear accelerator-injector into a booster of IPHE proton synchrotron are given. Correction technique of 3 db coaxial coupler (T bridge) parameters is presented. Calculated and experimental radiotechnical characteristics of a bridge phase inverter, smooth attenuator and parameters of oil-cooled ballast matched load are given as well. The devices considered consisted the foundation of the elementary basis of the original system of HF power introduction and provided its effective operation in the HF power circuit of 30 MeV accelerator-injector to the booster.

8292 **(SLAC-CN—257) One way to save the number of BPM buttons in the arcs that is not recommended.** Chao, A.; Kheifets, S. (Stanford Linear Accelerator Center, CA (USA)). Dec 1983. Contract AC03-76SF00515. 7p. NTIS, PC A02/MF A01. Order Number DE84004605.

It has been suggested as a possibility by the beam dynamic task force that the SLC arcs be provided a beam position monitor at every gap between magnets. In this scenario of orbit correction scheme, the BPM's are used alternately for the horizontal and the vertical orbit measurements. One way to construct these BPM's is therefore in the x and y planes. One problem of this construction, as pointed out by Pellegrin and Rees, is that synchrotron radiation will hit the buttons of the x-BPM's. It was suggested then that the x-BPM's should use four buttons, orthogonal, but rotated 45° from the x and y planes. This construction requires 4 buttons instead of 2, meaning an increase of cost. As an attempt to reduce the number of buttons needed for arc orbit correction, we have studied a variation of the orbit correction scheme. In this scheme, orbits are not corrected in the x and y coordinates but in the coordinates that are tilted by 45° relative to x and y. Let these coordinates be called u and v. The result of the study is that this scheme is not recommended.

8293 **Some applications of accelerators in chemistry and biology.** Rodgers, M.A.J. (Univ. of Texas, Austin, Texas 78712). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 2, 1772-1775(Apr 1981). (CONF-801111—).

From 6. conference on application of accelerators in research and industry; Denton, TX, USA (3 Nov 1980).

Some applications of particle accelerators in chemistry and biology are presented and discussed. Accent is placed on the use of electron storage rings to produce synchrotron radiation, the use of electron accelerators to probe the kinetic properties of shortlived chemical entities and on the radiation biological and biomedical uses of heavy ion beams.

4302 Beam Dynamics, Field Calculations, And Ion Optics

REFER ALSO TO CITATION(S) 8324, 8348, 8360, 8361, 8362

8294 (AD-A—131592/8) Dynasty II, a nonlinear implicit code for relativistic electron beam tracking studies. Memorandum report. Hui, B.; Lampe, M. (Naval Research Lab., Washington, DC (USA)). 27 Jul 1983. 23p. (NRL-MR—5138). NTIS, PC A02/MF A01.

The formulation of an implicit code Dynasty II is described. The code solves the EMPULSE equations without linearization. This code is applied to the study of beam tracking. Some applications are suggested.

8295 (CRN-PN—82-06) Transmission of charged particle beams through the Strasbourg MP tandem accelerator. Niemeskern, A. (Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires; Strasbourg-1 Univ., 67 (France)). 13 May 1982. 110p. (In French). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84750243.

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Transmission measurements through the Strasbourg MP tandem accelerator were obtained for various charged particle beams with A between 1 and 79. We have evaluated the importance of different parameters like the injection into the accelerator, the vacuum along the accelerating tube and the stripping at the terminal of the machine. We report also the results of lifetime measurements for carbon stripper foils at the MP terminal and for similar beam conditions than at the stripper of GANIL.

8296 (FERMILAB/TM—1139-A) Choice of tune and aperture of a circular collider. Teng, L.C. (Fermi National Accelerator Lab., Batavia, IL (USA)). 8 Nov 1982. Contract AC02-76CH03000. 4p. NTIS, PC A02/MF A01. Order Number DE84003317.

At low energies the considerations in the choice of the focusing strength (choice of nu) are the beam size and the orbit distortion due to field errors which, together, generate a geometrical requirement on the size of the beam pipe and the good field aperture. Indeed, the strong focusing principle was invented to reduce the necessary magnet aperture, thereby the cost of the magnets. But, at high energies this is no longer true. The beam size is, generally, negligibly small and the orbit distortion is corrected to arbitrary desired accuracy. With properly designed trim dipole system the correction is straightforward. Other types of geometrical demands on the aperture arise from beam manipulations such as stacking and resonant extraction. These requirements tend to be local and can usually be satisfied by local lattice insertions. The excitation of higher order resonances by magnet field errors is small and negligible beyond the octupole. However, in colliders the excitation by beam-beam forces is large and resonances up to the 7th order must be avoided. (This severely limits the allowable tune spread Δnu, hence the available Landau damping of beam instabilities.) But this excitation depends only on the orbit functions at the collision point and not on the overall focusing strength.

8297 (FERMILAB/TM—1234) Tevatron damper system. Moore, C.; Rice, R. (Fermi National Accelerator Lab., Batavia, IL (USA)). 21 Dec 1983. Contract AC02-76CH03000. 10p. NTIS, PC A02/MF A01. Order Number DE84005161.

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A fast beam damper system is currently being built for the Tevatron. The system is similar to the Super Damper system in the main ring with increased bandwidth and a pulsed high power mode for injection errors. The purpose of this writeup is to describe the basics of the system, and some of the reasoning behind its design. Calculations of expected performance are also included.

8298 (JINR—R-9-82-785) Computation of the autoacceleration force acting on the ring bunch of particles with a current moving along the semiinfinite coaxial system. Zhidkov, E.P.; Urazakov, Eh.I.; Shvachka, A.B. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1983. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704150.

The autoaccelerating force acting on the ring bunch of particles with oscillating current and the change of its kinetic energy as a result of passing through the section of the cylindrical waveguide with coaxial line are calculated. The considerable growth of the kinetic energy of bunch with large number of particles ($N > 10^{11}$) is greater than losses of energy as a result of radiation. As a result of solution the integral Fredholm equation of the first kind by Tikhonov's regularization method the growth of longitudinal impulse of bunch is calculated.

8299 (JINR—R-11-82-702) Magnetic field calculation by the method of integral equations in the case of constant magnetic permeability. Akishin, P.G.; Zhidkov, E.P. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1982. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704149.

Some problems arising in the process of solving the magnetostatic problems by the integral equation method are investigated. The case of corner points is studied. The algorithm of descritization of integral equations is given. Results of calculating the superconductive dipole of the "window frame" type are presented Rt.

8300 (JINR-D—1,2-82-27, pp 281-290) Possibilities of polarized proton acceleration. Derbenev, Ya.S.; Kondratenko, A.M. (AN SSSR, Novosibirsk. Inst. Yadernoj Fiziki). 1982. (In Russian). NTIS (US Sales Only), PC A15/MF A01. (CONF-811147—).

From International symposium on polarization phenomena at high energies; Dubna, USSR (17 Nov 1981).

Methods for suppression of depolarization for accelerators and storage rings associated with distortions of the magnetic system and field inhomogeneity are presented for obtaining polarized protons with succeeding acceleration. It is shown that depolarization can be removed using slow passing of modulation resonances. Methods based on essential reconstruction of spin motion are most prospective in high energy range. Polarization stability in fields arbitrarily changing on the trajectory is the basis of these methods.

8301 (JINR-D—1,2-82-27, pp 291-301) Analysis of methods for production of longitudinally polarized colliding beams in the VEPP-4 storage ring. Nikitin, S.A.; Saldin, E.L.; Yurkov, M.V. (AN SSSR, Novosibirsk. Inst. Yadernoj Fiziki). 1982. (In Russian). NTIS (US Sales Only), PC A15/MF A01. (CONF-811147—).

From International symposium on polarization phenomena at high energies; Dubna, USSR (17 Nov 1981).

Methods for obtaining longitudinal polarization of colliding beams in the VEPP-4 storage ring within 5 GeV energy range are analyzed. Location in opposite (technical) solenoid gap rotating the spin around the rate at phi=π angle is a possible method of longitudinal polarization in the experimental intermediate of the VEPP-4 storage ring in the energy range of psi-resonances. Spin kinematics in the scheme of obtaining longitudinal polarization in this energy range and for the energy of 5 GeV is described. The problem of obtaining longitudinal polarization of beams in the VEPP-4 storage ring within energy range of psi-resonances is much simplified by the fact that a magentic detector (MD) with vertical field rotating the spin at π angle is placed in the experimental gap of the given facility. It makes it possible to obtain longitudinal polarization in the centre of MD and to restore vertical polarization in half-rings by solenoids placed in straight-line gaps on both sides from MD. Variants of optics permitting to change the direction of beam polarization are described.

8302 (JINR-D—1,2-82-27, pp 302-307) **Colliding linear electron-positron beam conversion system for polarized beam production.** Balakin, V.E.; Mikhajlichenko, A.A. (AN SSSR, Novosibirsk. Inst. Yadernoj Fiziki). 1982. (In Russian). NTIS (US Sales Only), PC A15/MF A01. (CONF-811147—).

From International symposium on polarization phenomena at high energies; Dubna, USSR (17 Nov 1981).

A scheme of beam conversion with energy equal to hundreds of GeV with production of polarized positrons and electrons in the system of colliding linear electron-positron beams (CLEPB) is suggested. The method presupposes irradiation of a thin target by circular polarized high energy photon beams which, in their turn, are produced by passing an initial particle beam through a helical ondulator. Electron-positron pairs and Compton electrons which in turn are polarized on the upper boundary of energy spectrum in the direction of photon polarization, are produced in photon interaction with the target substance. Approximate figures characterizing the conversion system for the CLEPB complex are presented.

8303 (JINR-D—1,2-82-27, pp 308-311) **Charged particle spin flip in a storage ring with HF-electromagnetic field.** Polunin, A.A.; Shatupov, Yu.M. (AN SSSR, Novosibirsk. Inst. Yadernoj Fiziki). 1982. (In Russian). NTIS (US Sales Only), PC A15/MF A01. (CONF-811147—).

From International symposium on polarization phenomena at high energies; Dubna, USSR (17 Nov 1981).

An experiment for revealing a possibility of adiabatic electron spin flip in the VEPP-2M storage ring is described. High frequency longitudinal magnetic field up to 100 Gs at the length of 40 cm and frequency of 7.95 MHz was produced by a spiral of 10 coils supplied from HF-generator with 5 kW power. The control system is permitted to vary the generator frequency within $+\text{-}3\text{x}10^{-3}$ f during 10^{-3}-10 s. Determination of beam polarization degree was exercised by detection of electron elastic scattering inside the bunch. A possibility of changing the polarization sign at preservation of other beam parameters (dimensions, currents, energy, etc.) is of interest in experiments with polarized particles in storage rings. Spin flip can be exercised by effect on the beam of high frequency electromagnetic field, resonance with spin precession frequency around the leading field of the storage ring. The polarized 5 mA beam was produced due to radiation polarization at which electron spins are alinged along the direction of the magnetic field. Processing of the experimental results revealed good correspondence to analytical dependence. The depolarization value at the spin flip did not exceed 10%.

8304 (KFTI—81-52, pp 21-22) **Acceleration of electron beams in standing electromagnetic wave with tangential electric field near resonator walls.** Vishnyakov, V.A.; Rakityanskij, A.A.; Shenderovich, A.M. 1981. (In Russian). NTIS (US Sales Only), PC A05/MF A01. (CONF-8106218—No.3(9)).

From 7. all-union seminar on linear accelerators; Kharkov, Ukrainian SSR (2 Jun 1981).

Acceleration of electron beam in the TEsub(rel) field of wave in a cylindrical resonator is analyzed. There is only one component of electric field which is tangenstial to all the metal resonator walls in such wave, and on the walls themselves is close to zero. Evaluations made in the work by means of the Leontovitch boundary conditions showed that electric field intensity near copper resonator walls is several thousand times lower than maximum intensity of accelerating field inside the resonator. In consequence of this unlike usually used oscillation types in the given case there are practically no restrictions of possibility of increasing accelerating field intensity related to breakdown development. Determined were optimal dimensions of the resonator providing obtaining maximum intensity of accelerating field at the given supply power and operating frequency. Particle energy growth during resonator flight has been calculated depending on the distance between its trajectory and resonator axis. It is shown that still higher efficiency can be obtained during TEsub(rel) wave excitation in the cylindrical resonator with elliptical transversal cross section.

8305 (KFTI—81-52, pp 23-25) **Calculation of coupling electrodynamic systems.** Orlov, A.K. (Nauchno-Issledovatel'skij Inst. Ehlektrofizicheskoj Apparatury, Leningrad (USSR)). 1981. (In Russian). NTIS (US Sales Only), PC A05/MF A01. (CONF-8106218—No.3(9)).

From 7. all-union seminar on linear accelerators; Kharkov, Ukrainian SSR (2 Jun 1981).

Applicability of the method of partial areas for calculating electrodynamic systems with coupling holes has been studied. Problem of completeness of eigenvalue vector system is discussed in short. The Slater formulae were derived as sequence. Field in a slot was calculated and a dispersion equation for a chain of coupled resonators was derived. It is shown that in the coupling element a set of waves of the magnetic type is excited.

8306 (KFTI—81-52, pp 53-54) **Positron beam dynamics in linear accelerator.** Artemov, B.I.; Dobromirov, S.A.; Peev, F.A. 1981. (In Russian). NTIS (US Sales Only), PC A05/MF A01. (CONF-8106218—No.3(9)).

From 7. all-union seminar on linear accelerators; Kharkov, Ukrainian SSR (2 Jun 1981).

Mathematical modelling was used to investigate the dynamics of a longitudinal moving positron beam in a positron source (PS) of the Kharkov linear accelerator. PS includes a convertor device, short magnetic lens and two accelerating sections placed in a solenoid with a homogeneous field. The calculations were performed using the BESM-6 computer by means of the EMITRA program. The work permitted the determination of lens energy acceptance, the investigation of change of phase extent of positron bunch, energy spread and path of current flow of particles, depending on the phase of accelerating wave where the bunch is placed at the input of accelerating channel, and the study of bunch transformation in the energy-phase plane at different stages of acceleration in PS. It is shown that during the bunch introduction into retarding field near 170 deg phase the particle grouping and increase in density of beam phase volume occur. Positron energy spread at the output of a multisectional linear accelerator decreases two times because of the grouping effect.

8307 (KFTI—81-52, pp 60-62) **System of equations for numerical solution of charged particle dynamics problems in linear accelerators and evaluation of solution accuracy.** Kirpichnikov, G.A. (AN SSSR, Novosibirsk. Inst. Yadernoj Fiziki). 1981. (In Russian). NTIS (US Sales Only), PC A05/MF A01. (CONF-8106218—No.3(9)).

From 7. all-union seminar on linear accelerators; Kharkov, Ukrainian SSR (2 Jun 1981).

A set of equations of motion for numerical solution of problems of charged particle dynamics in linear accelerators has been obtained. They take into account the field of bunch volume charge, electric field nonlinearities in an accelerating structure resulting from the field inhomogeneity over a transverse channel section and its polyharmonicity, as well as aberrations of different orders of the focusing magnetic field of a solenoid. Accuracies of approximated formulae and problems obtained by means of the given set of equations are given.

8308 (KFTI—81-52, pp 64-66) **Asymmetry of angular distribution of synchrotron radiation.** Guk, I.S.; Gladkikh, P.I. 1981. (In Russian). NTIS (US Sales Only), PC A05/MF A01. (CONF-8106218—No.3(9)).

From 7. all-union seminar on linear accelerators; Kharkov, Ukrainian SSR (2 Jun 1981).

A mathematical model for calculating angular distribution of synchrotronous radiation (SR) was considered with provision for sizes and divergence of an electron beam at an arbitrary value of phase shift between linear components of SR polarization. Angular SR distribution, when changing the value of phase shift and inclination angle of polaroid ejecting radiation with a certain direction of oscillations was calculated, in wide ranges. Value and sign of the phase shift resulting in the asymmetry of angular SR distribution have been determined from experimental data and the calculation, coincidence of calculated and experimentally measured angular distributions at an accuracy of up to 2.5% has been obtained. It is experimentally established that double refraction in optical elements

arising under bremsstrahlung causes the phase shift additional to that predicted with theory.

8309 **(LA—9904-MS) Acceleration in a synchrotron by harmonic hopping.** Wilson, R.R. (Los Alamos National Lab., NM (USA)). Nov 1983. Contract W-7405-ENG-36. 10p. NTIS, PC A02/MF A01. Order Number DE84004480.

A method of accelerating protons in a synchrotron by changing from one harmonic to another in order to keep the beam near the center of the aperture without frequency-modulating the cavities is considered. Harmonic hopping is done by adiabatically debunching the beam and then rebunching it on a new harmonic. This should be possible to do without serious beam loss if a small amount, i.e., 2%, of frequency modulation is provided. Since the amount of ferrite varies as the square of the range of frequency modulation required, 16% in the case of LAMPF II, a considerable saving might be realized by using the harmonic-hopping method.

8310 **(LA—9927-MS) Equipartitioning in charged particle beams.** Channell, P.J. (Los Alamos National Lab., NM (USA)). Nov 1983. Contract W-7405-ENG-36. 9p. NTIS, PC A02/MF A01. Order Number DE84004534.

We derive the implications for charged particle beams of energy equipartitioning between the various degrees of freedom of single-particle motion. Because equipartitioned beams may be incompatible with most accelerator designs, we use a fluid theory in an attempt to investigate the equipartitioning rate that is due to collective instabilities. We find that nonequipartitioned fluid equilibria do not exist, thus casting doubt on previous analyses of the equipartitioning rate through instabilities.

8311 **(LAL-RT—83-05) Sixth order coupling resonances from the beam-beam interaction in e^+e^- storage rings.** Bambade, P. (Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire). Mar 1983. 26p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84750220.

The non-linear beam-beam interaction can excite coupling resonances that enlarge vertical beam dimensions in flat-beam operated machines and are hence harmful to luminosity achievements. Two such resonances are examined here using a first order averaging procedure: 2 Qsub(y) - 4 Qsub(x) = integer and 4 Qsub(y) - 2 Qsub(x) = integer. The effect on vertical amplitudes, when frequency split falls within predicted resonance band limits, is investigated. Effective resonance bands, taking into account amplitude distributions, are indicated and the limitations of the method are discussed.

8312 **(SLAC-CN—251) New magic angle bumps and magic translation bumps.** Seeman, J. (Stanford Linear Accelerator Center, CA (USA)). 28 Oct 1983. Contract AC03-76SF00515. 10p. NTIS, PC A02/MF A01. Order Number DE84003222.

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SLC beams of opposite charge can be transversely deflected in the same direction by RF fields in the accelerating cavities caused by girder tilts, coupler-asymmetries, or manufacturing errors. A symmetric deflection can be corrected by a magic angle bump if the deflection is located adjacent to one of the linac quadrupoles. However, if the deflection is located between quadrupoles, two magic angle bumps or a magic angle bump and a magic translation bump are needed for the correction. Several examples of translation bumps are included. A new magic angle bump is also presented which is longitudinally compressed and has significantly reduced particle excursions. Finally, if new correctors are added midway along the girders so that the number of correctors are doubled, then the longitudinal extent and the maximum particle excursion of these new magic bumps can be further reduced.

8313 **(SLAC-CN—253) Positron acceleration to 200 MeV.** Leboutet, H. (Stanford Linear Accelerator Center, CA (USA)). 11 Nov 1983. Contract AC03-76SF00515. 5p. NTIS, PC A02/MF A01. Order Number DE84003223.

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220 MeV is the energy that has to be obtained in routine operation. A standard 12m girder with SLED II can give 220 MeV minus a few percent due to not riding at the crest of the wave. In order to have the 200 MeV with only one girder, a klystron at full power all the time would be required - kept brand new. Then, for safety it is necessary to use two klystrons as designated in the SLC design. Having two klystrons gives freedom for the choice of the best arrangement. Since there will be excess rf power, it can be traded against higher gradient, shorter waveguides, larger apertures (lower shunt impedence).

8314 **(SLAC-CN—254) Attempt to compare two arc orbit correction schemes analytically.** Chao, A.; Weng, W. (Stanford Linear Accelerator Center, CA (USA)). 15 Dec 1983. Contract AC03-76SF00515. 11p. NTIS, PC A02/MF A01. Order Number DE84004228.

Consider a transport line that consists of periodic cells. Let the beam position monitors and the orbit correctors be located with the same period as the cells and let the BPM's and the corrector distributions interlace each other. The arrangement does not always provide a stable orbit correction. The criterion for stability has been derived by Joe Murray and is reproduced. We calculate the rms orbit, the effect of BPM errors and the rms corrector strength in such correction schemes, yielding analytic formulae for these quantities. We then apply these formulae to the SLC arcs.

8315 **(SLAC-CN—259) Lowering the beam in the SLC arcs.** Murray, J.J.; Servranckx, R.V. (Stanford Linear Accelerator Center, CA (USA)). 16 Dec 1983. Contract AC03-76SF00515. 1p. NTIS, PC A02/MF A01. Order Number DE84005033.

It has been decided, at least tentatively, to mount the arc magnets on pedestals, the motivation being to provide the most rigid support possible. In the same spirit the pedestals should be as short as possible. It has been proposed to shorten the pedestals by about 10 inches by either raising the floor of the tunnels or lowering the beams. A relatively simple means for lowering the beams is considered here.

8316 **(SLAC-CN—260) Optical transition radiation from a thin carbon foil: a beam profile monitor for the SLC.** Jenkins, E.W. (Stanford Linear Accelerator Center, CA (USA)). 1 Nov 1983. Contract AC03-76SF00515. 12p. NTIS, PC A02/MF A01. Order Number DE84004082.

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This memo considers placement of an ultra thin carbon foil into the SLC beam. Transition radiation light would be emitted from the surface of the foil. The optical spot from the foil could be viewed with a microscope objective lens and registered with an image detector. Multiple scattering for the foil thicknesses necessary will not affect the beam emittance. Calculations show that a thin carbon foil can withstand the electron beam if the electron beam is larger than 10 μm in size. There are many possible radiation mechanisms from a foil - bremsstrahlung, black body temperature radiation, Cerenkov light, scintillation light, and transition radiation. Transition radiation is apparently dominant. It is proposed to use thin carbon foils, 75 to 150 A thick. Calculations indicate that 5 x 10^{10} beam electrons will radiate a useable number of optical photons. Specifically with 150 A foils the fractional yield of useful optical photons is 10^{-3} photons per incident electron 5 x 10^{+7} optical photons imaged upon an image plane. Spread these photons over a 32 x 32 pixel CCD and one has the readout system of a monitor.

8317 **(UCID—19965) Model of current enhancement at high pressure.** Yu, S.S.; Melendez, R.E. (Lawrence Livermore National Lab., CA (USA)). 5 Apr 1983. Contract W-7405-ENG-48. 58p. NTIS, PC A04/MF A01. Order Number DE84005059.

A model is proposed to account for the phenomenon of net current enhancement at high pressures recently observed on the Experimental Test Accelerator. The proposed mechanism involves energetic secondary electrons (delta rays) which are pushed forward by the self-magnetic field of the electron beam. For high current beams, the forward delta ray current can build up to a significant fraction of the beam current. Analytic calculations of the steady-state solution as well as the rate of buildup of the delta ray current are presented in this paper. In addition, numerical results from a nonlocal Boltzmann code, NUTS, are presented. The analyt-

ic and numerical results have many features which are in qualitative agreement with the experiments, but quantitative discrepancies still exist.

4303 Auxiliaries And Components

REFER ALSO TO CITATION(S) 7251, 7323, 7324, 8008, 8265, 8367, 8715, 8732, 8823

8318 (BNL—33738) Brookhaven National Laboratory Tandem Facility. Lindgren, R. (Brookhaven National Lab., Upton, NY (USA)). 1983. Contract AC02-76CH00016. 3p. (CONF-8310236—1). NTIS, PC A02/MF A01. Order Number DE84002693.

From Symposium of Northeastern accelerator personnel; Rochester, NY, USA (3 Oct 1983).

Our MP7 accelerator has had about 70% utilization in the past year, clocking 6000 hours, of which approximately 10% was at terminal voltages between 14.75 and 16.25 MV. This pelletron system, installed in 1977, has logged 40,000 hours, and to date has broken five chains, three in the past four months. There are still two chains that have gone the total time. The injector machine, MP6, with its three chains installed in 1980, has accumulated 18000 hours with no chain failures. About six percent of the operating time in the past year was devoted to four-stage operation or accel-decel production of low energy highly stripped ions, for atomic physics experiments. This type of operation was improved by the addition of a remotely inserted gridded lens at the exit of the special last acceleration tube. Some examples of the beams we have produced are 2.5 MeV ^{35}Cl, Q16 10 na, 8 MeV ^{32}S, Q15 .5 na, 2.5 MeV ^{19}F, 09 20 na. We have acquired two General Ionex 860, Roy Middleton Mark VII sputter sources. One of these we have mounted on an ion pump, with integral focus lens, steerers and perture, and dedicated it to ^{14}C use, for injection into MP7. To date, from June, we have used it for four runs totaling 32 8-hour shifts, and 116 μa hours, with a maximum injected beam of 2.5 μa. The other 860 sputter source was used in a pulse mode to test for possible injection of the tandem accelerated heavy ion beam into BNL's AGS.

8319 (CAPE—2926) SLAC twitching beam positron target (Engineering Materials). (Stanford Linear Accelerator Center, CA (USA)). 1 Nov 1983. Contract AC03-76SF00515. TIC, PO Bx 62, Oak Ridge, TN 37831.

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Drawing 757-012-51 defines the basic unit of the twitching beam positron target as used at SLAC for generating a positron beam. The other drawing shows the target mounted in its carriage which provides a holder and a means of reaction, positioning and insertion into the beam line. This target is bombarded with electrons to provide a resulting spray of electrons and positrons. The positrons are collected and separated from the electrons and formed into a beam suitable for accelerating in this remaining two-thirds of the accelerator. The many other drawings of the positron source are not included in this group.

8320 (CAPE—2928) SLAC linear collider LINAC Beam Position Monitor (Engineering Materials). (Stanford Linear Accelerator Center, CA (USA)). 26 Jan 1983. Contract AC03-76SF00515. TIC, PO Bx 62, Oak Ridge, TN 37831.

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The drawings listed on the two drawing lists provide the data and specifications for constructing the SLC type Beam Position Monitor. These are stripline devices consisting of a vacuum pipe with four strips insulated from the pipe at one end. The beam pulse going through the device induces a pulse in the strips which is amplified and processed to give a signal which is proportional to the beam's position. This information is used to control a computer which can steer the beam or just be used as a position indicator. One of these devices will be used at each forty-foot point of the accelerator. A quadrupole encloses each monitor for focusing and a steering magnet is located nearby for closed loop focusing and storing.

8321 (CEA-N—2326) Data acquisition and control network. Hajjar, Victor. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France); Paris-11 Univ., 91 - Orsay (France)). Feb 1983. 144p. (In French). NTIS (US Sales Only), PC A07/MF A01. Order Number DE83704058.

We have participated in the construction of the CELLO detector on the PETRA e^+e^- Collider in Hamburg in order to test some of the current high energy physics theories. Some 60.000 channels collecting the detector informations are connected to the main computer through the CAMAC acquisition system and specialized ROMULUS subsystems. Each of these subsystems is monitored by its dedicated microprocessor using a CAMAC dataway spy module. All these microprocessors are connected to the main computer through a "STAR" type network. Data are read out by the main computer (PDP11-45) and concentrated in a circular type buffer. They are then filtered and transfered to a PDP11-55, also in the network, for storing.

8322 (DOE/SF/00515—T23) Stanford Linear Accelerator Center monthly report for November 1983. (Stanford Linear Accelerator Center, CA (USA)). 1983. Contract AC03-76SF00515. 21p. NTIS, PC A02/MF A01. Order Number DE84005022.

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Operational activities for the month of November 1983 are reported in the areas of accelerator and research operations, research area and experiment status, accelerator improvements, research division developments, PEP division developments, and publications for the month. (GHT)

8323 (FERMILAB/TM—1140) Collection of CASIM calculations. Cossairt, J.D. (Fermi National Accelerator Lab., Batavia, IL (USA)). 22 Oct 1982. Contract AC02-76CH03000. 23p. NTIS, PC A02/MF A01. Order Number DE84003376.

Portions are illegible in microfiche products.

Monte Carlo calculations of hadronic cascades at Fermilab have usually been done using the code CASIM written by A. Van Ginneken. These calculations are often performed to determine the quantity of shielding required for radiation protection purposes. A number of examples of such calculations have been presented previously. Several years of practical experience have led the author to develop the collection of additional cases included in the present report. These results along with those given earlier will serve as a useful reference. No attempt was made here to consider all possibilities; rather, the purpose was to develop a useful set of examples. Exceptionally intricate cases should, of course, receive individualized attention as appropriate.

8324 (FERMILAB/TM—1142) Effects of misalignments of the solenoid of the colliding-beams detector on the orbit of the beams. Teng, L.C. (Fermi National Accelerator Lab., Batavia, IL (USA)). Oct 1982. Contract AC02-76CH03000. 8p. NTIS, PC A02/MF A01. Order Number DE84003267.

Because the solenoid is very weak for 1 TeV beams, the alignment tolerances as far as the beams are concerned can be negligibly loose (The tolerances will be determined rather by accuracies for the measurement and analysis of particle tracks.) and there is no need to compensate for its orbital effects.

8325 (FERMILAB/TM—1147) Comparison of analytical and finite element results for deflections of CDF yoke and endplug. Wands, R. (Fermi National Accelerator Lab., Batavia, IL (USA)). 18 Nov 1982. Contract AC02-76CH03000. 16p. NTIS, PC A02/MF A01. Order Number DE84003591.

The purpose of this report is to compare the deflection results obtained by the finite element analysis of the CDF yoke and endplug with results arrived at by conventional analytical means. The analyzed structures are shown. The source for the closed form solutions is Formulas for Stress and Strain, by Raymond Roark and Warren Young. The tabulated comparisons of four deflections are given. Following the table are the details of the calculations.

8326 **(FERMILAB/TM—1208) Accelerator Division satellite refrigerator compressor system and gas purification procedures.** Pallaver, C.B.; Satti, J.A. (Fermi National Accelerator Lab., Batavia, IL (USA)). 8 Sep 1983. Contract AC02-76CH03000. 42p. NTIS, PC A03/MF A01. Order Number DE84004780.

Following construction and prior to commissioning a compressor system, it is necessary to test the piping, fill the purification vessels with adsorbents and remove all contaminants. The technical papers incoprorated in this report give detailed procedures for those tasks. (GHT)

8327 **(IFVE-OI—82-34) RF field stabilization system errors in linac-injector for booster.** Mal'tsev, I.G.; Nagaev, V.I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1982. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704146.

The character of compensation errors and their classification in the stabilization system with RF reflected-wave feedback are given. A method to estimate constant and accidental errors in this system has been proposed. The quantitative calculations of the stabilization errors in the Linac-Injector for the Booster are presented. The practical characteristics of the system links are shown to provide the required accuracy to maintain RF field in the accelerator cavity.

8328 **(IFVE-OUNK—82-72) Development of the kicker magnet system for the IHEP accelerator.** Andreev, V.N.; Kurnaev, O.V.; Sychev, V.A.; Trofimov, Yu.D. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1982. 11p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704148.

The KM-14 kicker magnet intended for joint operation with the KM-16 kicker magnet in the U-70 accelerator fast beam extraction system is described. The main characteristics and specific features of the magnet, pulse generators and power supplies are considered. The total aperture type KM-14 magnet (aperture height is equal to 100 mm, its width amounts 150 mm) consists of four modules which are supplied in pair-parallel by two pulse generators. The length of each module is 0.56 m, the field in a gap amounts 0.045 Tl. Joint use of the KM-14 and KM-16 magnets provides beam shooting into bending septum magnet when operating with the booster and beam extraction in the direction of the storage-accelerator complex.

8329 (JINR-D—1,2-82-27, pp 199-211) **Proton polarized "frozen" targets developed in JINR.** Borisov, N.S.; Bunyatov, Eh.I.; Kiselev, Yu.F.; Matafonov, V.N.; Neganov, B.S.; Neganov, A.B.; Usov, Yu.A.; Liburg, M.Yu. 1982. (In Russian). NTIS (US Sales Only), PC A15/MF A01.

In Spin in high energy physics.

Design, specifications and peculiarities of the most important units of proton polarized "frozen" targets (PPFT) for conducting experiments in the energy range up to 1 GeV and higher are described. The basic difference of "frozen" targets is cooling of working ugent up to the temperature below 0.1 K after attaining the maximal polarization using the dynamical method. The target may be placed after dynamic polarization in a weak and less uniform magnet field with large aperture. The "confining" field as well as proton spins can have any fixed or changing in the experiment direction. The scheme of vertical dissolution refrigerator is used in the first PPFT variant. A possibility of rapid replacement of samples at helium and nitrogen temperatures by a special rod is a significant design peculiarity. The diameter of the target is 2.8 cm, its length is 2.5 cm. Working agent is propadyol 10 g, magnetic field is equal to 2.69 T. A horizontal type crystal is used in the second variant. The diameter of the target is 19.6 mm, its length is 200 mm. Working agent is propadyol 44 g. The magnetic field is equal to 2.1 T. The degree of target polarization in the first variant is 98%, in the second one is 95%.

8330 (JINR-D—1,2-82-27, pp 224-233) **Polarized ion sources for high-energy accelerators.** Plis, Yu.A. 1982. (In Russian). NTIS (US Sales Only), PC A15/MF A01. (CONF-811147—).

From International symposium on polarization phenomena at high energies; Dubna, USSR (17 Nov 1981).

Methods for production of positive polarization ions are considered. A source of polarization protons, cryogenic source of polarization deuterons "Polaris" developed in JINR and the results of their tests are presented. It is shown that in recent years essential progress was made in the increase of both direct (up to 100 μA) and pulsed (up to 200 μA) currents of polarized protons and deutrons. The expressed ideas if realized, can make the intensity of accelerated polarized particles in synchrotrons of the same order of magnitude as non-polarized particles. Development of cryogenic sources, probably, with accumulation of polarized ions in the electron-beam trap is most interesting. A classical scheme of the method of atomic beam combining cryogenic and thermal joints is a perspective; it permits to attain direct current of polarized protons up to 200 μA. The method of laser pumping of polarization is perspective. Acceleration of polarized deuterons in the JINR synchrophasotron gives prospects for experimental investigations in high energy physics.

8331 (JINR-D—1,2-82-27, pp 241-247) **Polarized proton and deuteron targets for the usage in intensive proton beams.** Get'man, V.A.; Derkach, A.Ya.; Karnaukhov, I.M.; Lukhanin, A.A.; Razumnyj, A.A.; Sorokin, P.V.; Sporo, E.A.; Telegin, Yu.N. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1982. (In Russian). NTIS (US Sales Only), PC A15/MF A01. (CONF-811147—).

From International symposium on polarization phenomena at high energies; Dubna, USSR (17 Nov 1981).

Polarized proton and deuteron targets are developed and tested for conducting investigations in intense photon beams. A flowsheet of polarization targets which includes: working agent of the target, superconducting magnet, cryostat of ^{3}He evaporation with ^{3}He pumping and recirculation systems, SHF system of 4 mm range for polarization pumping, measuring system of target polarization protons is presented. Working agent of the targets includes frozen balls with 1.5 mm diameter. Ethylene-glucol and 1.2-propylene-glycol were used as a working substance for proton targets. Completely deuterated ethylene-glycol was used for the deuteron target. Vertical magnetic field with 2.7 T intensity is produced by a superconducting magnetic system. Polarization pumping is exercised at 75 GHz frequency. Q-meter of direct current is used for determination of polarization. Working temperature of the cryostat is approximately 0.5 K. The lock device permits replacement of the target working agent in 30 minutes.

8332 (JINR-D—1,2-82-27, pp 248-254) **Polarized jet-target for the experiment in a storage ring.** Popov, S.G.; Toporkov, D.K. (AN SSSR, Novosibirsk. Inst. Yadernoj Fiziki). 1982. (In Russian). NTIS (US Sales Only), PC A15/MF A01. (CONF-811147—).

From International symposium on polarization phenomena at high energies; Dubna, USSR (17 Nov 1981).

A possibility of cooling the escaping deuterium and producing a six-pole magnet with approximately 10 kGs field is investigated for conduction of experiments in the VEPP-2M storage ring with polarized deuterium jet-target. A HF generator with 20 MHz frequency of up to 5 kW power has been investigated for atom production. The discharge volume made of quartz glass with 30 mm diameter and 50 mm length has been cooled by running water. A non-cooled nozzle-channel with 2 mm diameter made in the disk of quartz glass and nozzle-channels with 2 and 1 mm diameter cooled by liquid nitrogen made of copper were investigated. The six-pole magnet was 150 mm long and it had 8 mm aperture. Omegatron RMO-1 was used for determination of atomic beam density. Calculation results of atomic beam thickness depending on the number of magnet poles, dependence of target thickness on distance outside the magnet are presented to choose the optimal magnet. It is shown that the twelve pole magnet provides high beam density but its design is more complex as compared with the six-pole magnet.

8333 (JINR-D—1,2-82-27, pp 255-267) **Methods for particle polarization and conservation in accelerators and storage rings.** Derbenev, Ya.S. (AN SSSR, Novosibirsk. Inst. Yadernoj Fiziki). 1982. (In Russian). NTIS (US Sales Only), PC A15/MF A01. (CONF-811147—).

From International symposium on polarization phenomena at high energies; Dubna, USSR (17 Nov 1981).

The present and prospective methods for production of electrons, positrons and heavy charged particles in a polarized state are reviewed. General properties of polarization dynamics in accelerators and storage rings are described. Choice of the necessary polarization direction, prevention of depolarization under acceleration, assurance of radiation selfpolarization of electrons and positrons in storage rings are considered. A laser method of high energy light particle beam polarization is described. Polarized high energy particles in accelerators can be obtained by injection from the source with succeeding acceleration. There exists another way for accelerators besides this classical method - beams are polarized under circulation mode after and during the process of storage using any effective polarizing mechanism. Possibilities of preserving a polarized state at long term beam circulation under acceleration or under a stationary mode as well as the necessary polarization direction in the given place of beam trajectory are described.

8334 (JINR-D—1,2-82-27, pp 268-277) **Laser technique for polarized electron and positron production in storage rings.** Derbenev, Ya.S.; Kondratenko, A.M.; Saldin, E.L. (AN SSSR, Novosibirsk. Inst. Yadernoj Fiziki). 1982. (In Russian). NTIS (US Sales Only), PC A15/MF A01. (CONF-811147—).

From International symposium on polarization phenomena at high energies; Dubna, USSR (17 Nov 1981).

A possibility is revealed and calculation results are presented of electron and positron polarization by colliding circular polarized photons in storage rings within submillimeter range at polarization by soft photons and in the region of vacuum ultraviolet at polarization by hard photons. A relativistic electron beam passing through a spiral open ondulator is used as a source of circular polarized radiation. The results of numerical evaluations on the example of LEP storage rings are presented.

8335 (KFTI—81-52, pp 8-11) **Development of heavy ion sources for linear accelerators.** Meleshkov, S.I.; Skoromnyj, G.M.; Rudyak, B.I.; Reshetnikov, V.N.; Pletnikov, L.B. 1981. (In Russian). NTIS (US Sales Only), PC A05/MF A01. (CONF-8106218—No.3(9)).

From 7. all-union seminar on linear accelerators; Kharkov, Ukrainian SSR (2 Jun 1981).

Preliminary results of tests of multicharged ion sources of the Penning and spark types developed for an in ector of a heavy ion linac are stated. Some their structural peculiarities related to specific operating conditions of ion sources on a high-voltage terminal of the injector are described. Test results for carbon, argon and rkypton ions are tabulated.

8336 (KFTI—81-52, pp 12-13) **Investigation and tuning of positron source for Kharkov linear accelerator.** Artemov, V.I.; Vishnyakov, V.A.; Dem'yanenko, G.K.; Dobromirov, S.A.; Kobezskij, V.M.; Peev, F.A.; Fisun, A.N. 1981. (In Russian). NTIS (US Sales Only), PC A05/MF A01. (CONF-8106218—No.3(9)).

From 7. all-union seminar on linear accelerators; Kharkov, Ukrainian SSR (2 Jun 1981).

Results of investigation and tuning of a positron source (PS) at the UkSSR Academy of Sciences KhFTI electron linac are stated. Parameters of accelerating and focusing PS fields, which would provide the production of beam with maximum positron current, were searched for. Structural PS flow-sheet is given as well as a measuring complex which was constructed for the metrological provision of experiments and installed between PS and the accelerator proper. Distribution of magnetic induction of a longitudinal focusing field is presented. Optimal values of focusing fields and input phase of accelerating field, at which at the PS output produced was a positron beam of 50 nA mean current and 43 MeV energy, are given. Net conversion coefficient representing relation of positron current at the PS output to the current of the primary electron beam on a convertor, constituted 1×10^{3}. Positron beam of 10 nA current and 1200 MeV energy was produced at the accelerator output.

8337 (KFTI—81-52, pp 14-15) **Accelerating cell with optimum use of SHF-source power.** Kramskoj, G.D.; Makhnenko, L.A.; Mufel', V.B. 1981. (In Russian). NTIS (US Sales Only), PC A05/MF A01. (CONF-8106218—No.3(9)).

From 7. all-union seminar on linear accelerators; Kharkov, Ukrainian SSR (2 Jun 1981).

Results of experimental investigations into an accelerating cell of an electron linac are stated. The cell represents a travelling wave resonator and contains short (170 cm) low-dispersed accelerating section with constant geometry of transversal cross section and working type of oscillations $\pi/2$, waveguide phase inverter, matching element and directional coupler with the controlled coupling coefficient. The presence of the latter permits to optimally use SHF oscillation source capacity when changing in a wide range (from 10 to 500 mA) accelerated particle beam current. Weakening of transversal instability results from shortening of the section length and introduction of radial sections of a variable length into waveguide diaphragms) beside such system permits to increase electric strength of the section and to decrease particle energy spread. Experiments were performed at 20 MeV linear accelerator. Given are an experimental device flowsheet, dependences of the coupling coefficient and coupler direction on the positron of a control device, calculated and experimental dependences of energy growth on electron beam current, energy spectra of accelerated electrons. Particle beam parameters measured experimentally agree well with calculated ones and exceed parameters of the best operating sections with variable geometry.

8338 (KFTI—81-52, pp 16-18) **Compact electron linear accelerator with accelerating structure having annular coupling cells.** Zverev, B.V.; Ruzin, V.V.; Sobenin, N.P. (Moskovskij Inzhenerno-Fizicheskij Inst. (USSR)). 1981. (In Russian). NTIS (US Sales Only), PC A05/MF A01. (CONF-8106218—No.3(9)).

From 7. all-union seminar on linear accelerators; Kharkov, Ukrainian SSR (2 Jun 1981).

Structural peculiarities of two-sectional electron linac with power supply from a magnetron through 3 db dridge are described. The above accelerator is different from the similar REhLUS-1 accelerator, which began to operate earlier, in a higher rate of gaining energy - 9 MeV, as well as in considerably lesser dimensions. The accelerator uses an accelerating structure with annular coupling cells having branch resistance by 20% higher as compared with the structure with inner coupling cells. A buncher consisting of two cells with equivalent phase velocities $\beta=0.66$ and $\beta_s=0.86$ is the part of the first section. When adjusting accelerating sections used was a specially developed adjustment technique as well as Shipr-4 automatic measuring complex with exposing measurement results on the PL-80 perforator and successive processing by the ES series computer. Calculated load characteristics of the accelerator are given. From March 1980 the accelerator operates in the test regime. During the period from March till November 1980 the accelerator operated over 650 h, at that, over 300 h - according to the program of devices and materials irradiation. Maximum energy of 6.0 MeV (at 15 mA beam current) was generated at the accelerator at 1.4 MW magnetron power.

8339 (KFTI—81-52, pp 19-20) **Accelerating cell with variable geometry of cross section and the 2/3 π oscillation operating mode.** Vishnyakov, V.A.; Grizhko, V.M.; Zykov, A.I. (and others). 1981. (In Russian). NTIS (US Sales Only), PC A05/MF A01. (CONF-8106218—No.3(9)).

From 7. all-union seminar on linear accelerators; Kharkov, Ukrainian SSR (2 Jun 1981).

Results of tests of an accelerating section with variable geometry and working type of oscillations $2/3\pi$ for electron linacs of 10 cm wave range are described. Experimental investigations carried on at small level of power and in the acceleration regime showed satisfactorily agreement with calculated parameters of the section. 52 MeV energy growth was obtained at 441 cm section length at 16.4 MW output power and 20 mA beam current. The following specific features was noted: as the section is high-dispersed, requirements to stability of supporting frequency of SHF oscillations and temperature of the section increase; divergence of a charged particle beam at the section output must not exceed 10^{-3} for good current diagram; large losses of beam current for radiation

and increase of its divergence with current growth decrease efficiency of section use at pulse current over 200 mA.

8340 (KFTI—81-52, pp 26-27) **Prestripper section with quadrupole-focusing accelerating structure ("Muravej"-type).** Arsen'ev, V.V.; Bezrodnyj, Yu.G.; Bomko, V.A.; Goncharenko, N.I.; D'yachenko, A.F.; Meleshkova, Yu.V.; Pipa, A.V.; Revutskij, E.I.; Rudyak, B.I.; Khizhnyak, N.A. 1981. (In Russian). NTIS (US Sales Only), PC A05/MF A01. (CONF-8106218—No.3(9)).

From 7. all-union seminar on linear accelerators; Kharkov, Ukrainian SSR (2 Jun 1981).

Results of investigations into development of a hard-focusing version of a prestripper section of linear accelerator of multicharged ions for ion acceleration with ratio of mass number to charge A/q <= 22 up to 1 MeV/nucl energy are stated. It is based on a new modification of an accelerating structure of oncoming pins type with drift tubes excited at the wave of the type H_3 (Muravej). This makes it possible to increase working length of the wave up to 12.6 m in the resonator of the former diameter (1.5 m). Basic characteristics of such accelerating section are given and investigaties of ion beams of different kinds are evaluated.

8341 (KFTI—81-52, pp 28-31) **Resonance systems for the H-type accelerating structure tuning.** Bomko, V.A.; D'yachenko, A.F.; Pipa, A.V. 1981. (In Russian). NTIS (US Sales Only), PC A05/MF A01. (CONF-8106218—No.3(9)).

From 7. all-union seminar on linear accelerators; Kharkov, Ukrainian SSR (2 Jun 1981).

Results of the new modification development of an accelerating structure of oncoming pins type with drift tubes excited at the H_3 type wave are described. The main achievement during development of the mentioned structure is the construction of adjustment devices of a new type-nonresonance and resonance - which for the first time permitted to form in the structure of the oncoming pin type homogeneous distribution of accelerating field in a real accelerator of a large length and to adjust it to a required working frequency. This permitted to obtain the highest rate of heavy ion acceleration.

8342 (KFTI—81-52, pp 32-33) **Method of plane peak current pulse shaping in ion circuit electromagnetic devices.** Kozodaev, A.M.; Lazarev, N.V.; Skachkov, V.S.; Stasevich, Yu.B. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1981. (In Russian). NTIS (US Sales Only), PC A05/MF A01. (CONF-8106218—No.3(9)).

From 7. all-union seminar on linear accelerators; Kharkov, Ukrainian SSR (2 Jun 1981).

Data on a new method of shaping current pulses with a plane vortex using support forces of necessary load voltage are given. Additional inductance is suggested to introduce into a circuit of oscillatory discharge of a capacitor and at the moment of reaching the given current value to connect in parallel to load winding a parametric voltage stabilizer in the form of high-current diode (or stabilizer) and thyristor connected in series. Vertex instability can be reduced when using the high-current transistor with a feedback circuit controlling the current value instead of the parametric stabilizer. Plane vortexes of pulses of 10^{-4}-10^{-3} instability and 0.01-1 μs duration in the current range from 1 to 120 A have been obtained. Ratio of plane pulse part duration and duration on the foundation is not less than 0.7. The method suggested doesn't require additional power supply sources and preliminary stabilization of the charge voltage. It is used with success in power supply system for I-2 accelerator ionguide elements.

8343 (KFTI—81-52, pp 34-35) **Multifunctional system for beam parameter measuring in small energy linear electron accelerator.** Alekseev, L.K.; Vikulov, V.F.; Glazov, A.I.; Murin, V.Yu.; Pavlov, Yu.S.; Solov'ev, N.G.; Sushinin, Yu.V. (Moskovskij Inzhenerno-Fizicheskij Inst. (USSR)). 1981. (In Russian). NTIS (US Sales Only), PC A05/MF A01. (CONF-8106218—No.3(9)).

From 7. all-union seminar on linear accelerators; Kharkov, Ukrainian SSR (2 Jun 1981).

A set of measuring apparatuses for electron accelerators with a wide range of smooth control of beam parameters is considered. Duration of accelerator current pulse changes from 3 μs to 100 ns. The set includes magnetoinduction, electrooptical, resonator, coaxial and other sensors. Sensor characteristics are given and their structures are described. Unit for electron processing of signals from the sensors is considered as well. It is shown that the developed set of the measuring apparatuses obtains sufficiently complete data on the beam parameters at all the stages of the acceleration process in an electron linac consisting of a buncher and two sections.

8344 (KFTI—81-52, pp 36-37) **Beam parameter measurement system for heavy-current electron accelerator.** Protasov, A.K.; Rybin, V.M.; Borodulin, A.I.; Mamaev, G.L. (Moskovskij Inzhenerno-Fizicheskij Inst. (USSR)). 1981. (In Russian). NTIS (US Sales Only), PC A05/MF A01. (CONF-8106218—No.3(9)).

From 7. all-union seminar on linear accelerators; Kharkov, Ukrainian SSR (2 Jun 1981).

A structural flowsheet of a system for measuring beam current and energy of a heavy current low-energy electron accelerator is given. Unit structure of a primary data converter combined with a measuring device of beam parameters on the basis of an acoustic converter and Faraday cylinder is described. High noise-resistance of the beam energy measurement channel is obtained by the delay of acoustic pulses excited with the beam in absorber and propagated in a target. For the blocking of the measuring channel during noise effects are linear transmission circuit and time delay device used to the input of which go synchropulses from the accelerator control circuit. A measurement technique is described and experimental investigation results are given. Measurement error of beam current in the range from 10 to 100 A doesn't exceed 4 and 15% of beam energy in the range from 200 to 400 keV.

8345 (KFTI—81-52, pp 38- 9) **Control and accelerating voltage automatic pulse acquisition system for "LIU-5/5000" linear accelerators.** Maslov, V.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1981. (In Russian). NTIS (US Sales Only), PC A05/MF A01. (CONF-8106218—No.3(9)).

From 7. all-union seminar on linear accelerators; Kharkov, Ukrainian SSR (2 Jun 1981).

A system prowiding continuous control and automatic correction of actuation of accelerating voltage pulse generators of a linear induction accelerator is described. TGI-2500/50 thyratrons are switching elements of the generators. Shaped pulses have a bell form, their duration on the foundation constitutes 300 ns. The device operation is based on the determination of a sign of time error between generator and reference pulses. Depending on the error sign, correction of the delay value included into the actuation circuit of the corresponding generator is performed. Such operation is accomplished in each working pulse of the accelerator. Data on the delay condition go to the digital panel and digital print-out. Technical characteristics of the system are the following: 56 cynchronization channels, 155 ns control interval, 5 ns control pitch, error of the error determination is not worse than +-2.5 ns. The system improves accelerated beam stability and simplifies accelerator tuning and control.

8346 (KFTI—81-52, pp 40-41) **Synchronization system for electron linear accelerator.** Azarov, A.S.; Borzhkovskij, V.F.; Vlasov, V.G.; Kostenets, Yu.V.; Mukhachev, N.K.; Sinaevskij, A.D.; Solov'ev, V.S.; Stervoedov, N.G.; Frolov, A.I. (Khar'kovskij Gosudarstvennyj Univ. (Ukrainian SSR)). 1981. (In Russian). NTIS (US Sales Only), PC A05/MF A01. (CONF-8106218—No.3(9)).

From 7. all-union seminar on linear accelerators; Kharkov, Ukrainian SSR (2 Jun 1981).

A system for synchronization of an electron linac is described providing reliable synchronous actuation of accelerator units at pulse frequency from single actuation to 1200 Hz, stabilization of mean current of an electron beam, automatic reduction of mean beam current when exceeding radiation safety standards, protection of clustron pulse amplifiers (CPa) in case of high-frequency breakdown, and digital indication of CPa actuation frequency and pulse frequency. Rigid fixation of starting pulses to an arbitrary

chosen phase of a three-phase power line is reached with the application of frequency phase autotuning. Synchropulse delay during 0-20 ms (which corresponds to shift phase of 0-360 deg) with 20 μs pitch and fine synchropulse delay tuning for separate accelerator units in the range of 0-35.6 μs with 50 ns pitch is performed with digital lines of delay providing high time and temperature stabilities.

8347 (KFTI—81-52, pp 42-45) **Method of beam disturbance diagnostics by beam loss analysis at start-adjustment conditions of the "MEGAN" accelerator.** Burlakov, V.D.; P'yankov, V.V.; Fedotov, A.P. (AN SSSR, Moscow. Inst. Yadernykh Issledovanij). 1981. (In Russian). NTIS (US Sales Only), PC A05/MF A01. (CONF-8106218—No.3(9)).

From 7. all-union seminar on linear accelerators; Kharkov, Ukrainian SSR (2 Jun 1981).

Method bases for diagnostics of beam disturbances from analysis of beam losses in linear accelerators-meson generators are stated. Considered are main kinds of beam disturbances: disturbance of longitudinal moving of particles, disturbance of transverse moving of particles and recharging of accelerated ions with residual gas. Beam losses resulted from the three disturbance kinds were delineated on the basis of analysis of loss distribution and variation with focusing parameters of an accelerator channel and possibilities of the disturbance diagnostics method when adjusting the most complex sections of the MEGAN accelerator are discussed. Experience of adjustment and alignment at the LAMPF accelerator has been analyzed.

8348 (KFTI—81-52, pp 46-47) **Observation technique of proton beam high-frequency structure in the "I-2" linear accelerator.** Kujbida, R.P.; Romanovskij, R.A.; Stolbunov, V.S. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1981. (In Russian). NTIS (US Sales Only), PC A05/MF A01. (CONF-8106218—No.3(9)).

From 7. all-union seminar on linear accelerators; Kharkov, Ukrainian SSR (2 Jun 1981).

System for observing the high-frequency beam structure of accelerated protons at the output of the I-2 linear resonance accelerator being the injector of the ITEPH proton synchrotron is described. Duration of each particle bunch at the accelerator output amounts to 1 ns. To measure current pulses of nanosecond duration, is a wide-band current collector is developed in which the variation in frequency response constitutes +-3 db in the range from 100-800 MHz. The current collector signal is transferred to an oscillograph with a coaxial cable. To match the cable, the current collector is made in the form of a section of a coaxial line of a variable diameter. Current collector tests using a beam have shown that the given measuring system permits one to visually observe the high-frequency structure of the accelerated proton beam on the S7-10A oscillograph screen.

8349 (KFTI—81-52, pp 48-49) **Circuit for eigenfrequency of accelerator resonators control.** Belyaev, O.K.; Stepanov, V.B. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1981. (In Russian). NTIS (US Sales Only), PC A05/MF A01. (CONF-8106218—No.3(9)).

From 7. all-union seminar on linear accelerators; Kharkov, Ukrainian SSR (2 Jun 1981).

A circuit for controlling eigenfrequency of accelerator resonators of the URAL-30 accelerator-injector for the booster of a proton synchrotron is presented. During the accelerator operation in the mode of little duration of powerful HF feeding pulses the eigenfrequency is controlled during specings between HF power pulses. A phasometric device of frequency control circuit is made on the section of the coaxial line. To increase steepness of standing wave in the coaxial line, one matching attenuator is excluded out of the konwn phasometric device. Stationary processes in the improved phasometric device were considered in detail. The field change performed permits to accomplish weak connection of the frequency control circuit with accelerator resonators. Detuning of the resonators with circuit elements constitutes not more than 300 Hz in the mode of accelerator operation. Indication of the results obtained is accomplished with a microammeter having 50-0-50 μA scale. Resonator detuning by +-1.5 kHz corresponds to +-20 μA device reading. Protection of the control circuit from working pulses is provided with a set of weak coupling and additional quarter-wave stubs.

8350 (KFTI—81-52, pp 50-52) **Probe calibration for measuring of RF electric intensity absolute value in cavity resonators.** Kutovoj, V.A.; Makhan'kov, V.I.; Sidorenko, I.S. 1981. (In Russian). NTIS (US Sales Only), PC A05/MF A01. (CONF-8106218—No.3(9)).

From 7. all-union seminar on linear accelerators; Kharkov, Ukrainian SSR (2 Jun 1981).

Structure of a symmetrical flat-parallel gauging condensor for calibration of measuring probes in the frequency range of 50-800 MHz is described. Results of investigation into the chosen structure of the gauging condensor are given. The structure permits to simplify the probe calibration process and to exclude partially errors of measuring circuits. A technique for measuring an absolute value of electric HF field intensity in the investigated resonator of a complex configuration based on the method of comparison with the known field by means of calibrated measuring wall probe at small power levels at +-15% accuracy is stated. The technique permits to simplify measurements in resonators for which exact analytical calculation of field intensity cannot be performed.

8351 (KFTI—81-52, pp 63) **Nanosecond electron source with ray heating and increased-frequency solid modulator.** Meshkov, A.N.; Barmin, A.V. (Gor'kovskij Politekhnicheskij Inst. (USSR)); Smirnov, V.N.; Shishko, V.I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1981. (In Russian). NTIS (US Sales Only), PC A05/MF A01. (CONF-8106218—No.3(9)).

From 7. all-union seminar on linear accelerators; Kharkov, Ukrainian SSR (2 Jun 1981).

A power supply system for an electron gun-injector of a 60 MeV heavy-current accelerator is considered. In this system the cathode is heated with a 5 keV additional electron beam. A discrete-distributed generator with 50 kV voltage and 1.5 Hz pulse repetition rate serves as a modulator. During the test of the generator together with the gun of an electron beam pulse of 70A current at the gun output was produced; pulse duration-10 ns, durations of front and decay-2 ns.

8352 **(LA—9889-MS) 4-GeV preaccelerator for LAMPF II.** Colton, E. (Los Alamos National Lab., NM (USA)). Nov 1983. Contract W-7405-ENG-36. 12p. NTIS, PC A02/MF A01. Order Number DE84004533.

A preliminary design for a 0.8- to 4.0-GeV, 30-Hz preaccelerator for LAMPF II is presented. The machine is round and is approximately the same circumference as the LAMPF II rings, thus permitting single-turn injection into the 4- to 32-GeV accelerator. Large-aperture, low-field dipoles permit acceleration of high-current proton beams.

8353 **(RL—82-084) Automatic sample changer for use on the SNS.** (Science Research Council, Chilton (UK). Rutherford and Appleton Labs.). Oct 1982. 9p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704152.

A design for an Automatic Room Temperature Sample Changer suitable for any completely contained sample - gas, liquid or solid - has been produced. Samples can be moved in any sequence into the neutron beam. The design was evolved primarily to suit SNS instruments. A prototype was constructed specifically for the LAD spectrometer having ten sample positions. The accuracy of the sample positioning was determined.

8354 **High heat flux target for intense neutron source.** Bacon, F.M.; Cowgill, D.F.; Hickox, C.E.; Walko, R.J.; Subia, S.R. Jr.; Riedel, A.A. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Review of Scientific Instruments;* **55**: No. 1, 42-47(Jan 1984).

A 200-kV, 200-mA deuterium ion accelerator has been developed to simulate the operation of an intense neutron source for use in cancer therapy. The thin-film ScD_2 target for the neutron

source is supported on a water-cooled copper substrate designed to dissipate 40MW/m² at a surface temperature of 450 °C. This paper describes the theoretical and experimental analysis of the target and the postmortem analysis of a target after 140 h of operation at power densities exceeding 40 MW/m². Cooling channel erosion due to nucleate boiling of the cooling water was shown to be the life-limiting feature of the target design.

8355 **Beam polarization at the ZGS.** Spinka, H.; Colton, E.; Ditzler, W.R.; Halpern, H.; Imai, K.; Stanek, R.; Tamura, N.; Theodosiou, G.; Toshioka, K.; Underwood, D. (Argonne National Lab., IL (USA)). *Nuclear Instruments and Methods in Physics Research;* **211**: No. 2/3, 239-261(15 Jun 1983).

With 93 refs.

A description is given of a beam polarimeter constructed for use at the Argonne ZGS and later at LAMPF. Details of the absolute calibration of these polarimeters are described. Conclusions for the absolute beam polarization at the ZGS impact a number of past polarized beam experiments, causing normalization changes in some cases of 8-25%. The normalization of some past pp polarization measurements are also affected by these results.

8356 **Initial operation of the Holifield Facility.** Ball, J.B. (Oak Ridge National Lab, Oak Ridge, TN 37830). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **30**: No. 2, 1363-1366(Apr 1983). Contract W-7405-ENG-26.

The Holifield Heavy Ion Research Facility (HHIRF) is located at Oak Ridge National Laboratory and operated, by the Physics Division, as a national user facility for research in heavy-ion science. The facility operates two accelerators: the new pelletron electrostatic accelerator, designed to accelerate all ions at terminal potentials up to 25 million volts, and the Oak Ridge Isochronous Cyclotron (ORIC) which, in addition to its stand-alone capabilities, has been modified to serve also as a booster accelerator for ion beams from the Pelletron. In addition, a number of state-of-the-art experimental devices, a new data acquisition computer system, and special user accommodations have been implemented as part of the facility. The construction of the facility was completed officially in June of this year. This paper reports on the present status of facility operation, observations from testing and running of the 25 MV Pelletron, experience with coupled operation of the Pelletron with the ORIC booster, and a brief summary of the experimental devices now available at the facility.

8357 **Superconducting conversion of the Oak Ridge isochronous cyclotron.** Martin, J.A.; Ball, J.B.; Cleary, T.P. (Physics Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee (USA)) (and others). pp 225-227 of 9. International conference on cyclotrons and their applications. Gendreau, G. (ed.). Les Ulis, France; Les Editions de la Physique (1982). (CONF-810944—).

From 9. international conference on cyclotrons and their applications; Caen, France (7 Sep 1981).

The superconducting conversion of ORIC is being planned to replace the aluminum main magnet coils with a NbTi superconducting coil system. The average magnetic field would be increased from the present 1.9 T to 3.3 T to provide a maximum increase in energy from 100 to 300 q^2/A^2.

8358 **Multiple scattering of protons and deuterons by thick foils.** Dixon, D.R.; Connors, C.J.; Gould, C.R.; Jensen, G.L.; Morrill, S.M.; Thombiduria, P.M.; Walter, R.L. (Brigham Young University, Provo, Utah 84602). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 2, 1295-1297(Apr 1981). (CONF-801111—).

From 6. conference on application of accelerators in research and industry; Denton, TX, USA (3 Nov 1980).

Protons and deuterons from the Triangle Universities Nuclear Laboratory (TUNL) tandem Van de Graaff of energies 3.0, 4.0, and 5.0 MeV were scattered from foils of Al, Ni, Mo, and Ta having thicknesses of 6.14 to 47 mg/cm². Multiple scattering angular distributions were measured using a position-sensitive detector to collect data at nine different angles simultaneously. Gaussian curves were fitted to the central points of the distributions and the angles thus 1erived are presented graphically. The data points are compared with calculations using a common method of determining multiple scattering angles. An empirical correction for extending this method into the low energy and thick foil region considered here is suggested.

4304 Storage Rings

REFER ALSO TO CITATION(S) 8143, 8296, 8301, 8303, 8321

8359 **(CAPE—2925) SLAC SPEAR Q-2 vacuum chamber (Engineering Materials).** (Stanford Linear Accelerator Center, CA (USA)). 27 Dec 1983. Contract AC03-76SF00515. TIC, PO Bx 62, Oak Ridge, TN 37831.

Portions are illegible in microfiche products1 35-mm aperture cards.

The drawings listed on the auxiliary drawing list provide the data and specifications for the construction of the Q-2 vacuum chamber which is inside an interaction region quadrupole magnet. This pipe or chamber provides a means of transporting the electrons and positrons through the quadrupole magnet and connects with the rest of the vacuum system of the SPEAR storage ring.

8360 **(FERMILAB/TM—1223) Exact solutions for the longitudinal and transverse impedances of an off-centered beam in a rectangular beampipe.** Ng, K.Y. (Fermi National Accelerator Lab., Batavia, IL (USA)). Sep 1983. Contract AC02-76CH03000. 20p. NTIS, PC A02/MF A01. Order Number DE84004779.

In storage rings and accumulators, some sections of the beampipe may be rectangular in cross section and the beam may not be at the center of the beampipe. In this note, through conformal mapping, we try to compute exactly the longitudinal, vertical and horizontal transverse impedances for the beam under these circumstances. For simplicity, we restrict the beam to the horizontal symmetry axis of the beampipe. Both the effects due to the resistivity of the beampipe's wall and space-charge are considered.

8361 **(FERMILAB/TM—1224) Computer program for calculating the resonant frequency, shunt impedance and quality factor of a pill-box cavity in a storage ring.** Aguero, V.M.; Ng, K.Y. (Fermi National Accelerator Lab., Batavia, IL (USA)). Oct 1983. Contract AC02-76CH03000. 37p. NTIS, PC A03/MF A01. Order Number DE84004922.

Portions are illegible in microfiche products.

Keil and Zotter have analyzed the electromagnetic fields excited by the longitudinal density fluctuations of an unbunched relativistic particle beam drifting in a corrugated vacuum chamber of circular cross section. At higher frequencies, these corrugations become resonant cavities. Zotter has written a computer program known as KN7C to compute the resonant frequencies. However, in the actual use of KN7C, some difficulties are encountered. To surmount these difficulties, the program known as CAVITY was written to analyze this pill-box shaped resonant cavity. Although there are many input variables to this program, only two are essential and need to be specified. They are BD = b/d = the ratio of the circular beampipe radius to that of the pill-box cavity and GD = g/d where g is the length of the cavity. When they are specified, CAVITY will print out the dimensionless normalized fundamental resonant frequency FD, shunt impedance Z and figure of merit Q. From these, the actual resonant frequency, shunt impedance and figure of merit can be deduced. The program is described and a listing is provided.

8362 **(FERMILAB/TM—1227) Elementary stochastic cooling.** Tollestrup, A.V.; Dugan, G. (Fermi National Accelerator Lab., Batavia, IL (USA)). Dec 1983. Contract AC02-76CH03000. 106p. NTIS, PC A06/MF A01. Order Number DE84004778.

Major headings in this review include: proton sources; antiproton production; antiproton sources and Liouville, the role of the Debuncher; transverse stochastic cooling, time domain; the accumulator; frequency domain; pickups and kickers; Fokker-Planck

equation; calculation of constants in the Fokker-Planck equation; and beam feedback. (GHT)

8363 (JINR-D—1,2-82-27, pp 278-280) **Possibility of using synchrotron radiation for measuring electron polarization in storage rings.** Bondar', E.A.; Saldin, E.L. (AN SSSR, Novosibirsk. Inst. Yadernoj Fiziki). 1982. (In Russian). NTIS (US Sales Only), PC A15/MF A01. (CONF-811147—).

From International symposium on polarization phenomena at high energies; Dubna, USSR (17 Nov 1981).

Discussion of problems associated with practical realization of the method for determination of transverse electron polarization in the storage ring by synchrotron radiation (SR) was the purpose of investigation. The method comprises measuring of spin error to SR intensity. A large number of SR photons makes it possible to determine polarization during several seconds. It is suggested that SR intensity from one-period compensated battery with 22 kGs field of central magnet and 20 cm pole length should be measured in the VEPP-4 storage ring. The Cherenkov counter is suggested to be used as a threshold detector.

8364 (JINR-D—1,2-82-27, pp 312-319) **Precise experiments with polarized beams on storage rings.** Shatunov, Yu.M. 1982. (In Russian). NTIS (US Sales Only), PC A15/MF A01. (CONF-811147—).

From International symposium on polarization phenomena at high energies; Dubna, USSR (17 Nov 1981).

Experimental results on energy calibration of particles radiation-polarized in the storage ring are presented. A calibration technique depending on polarization of the process of particle elastic scattering at transverse oscillations inside the bunch is used. After scattering two particles have energies essentially different from the equilibria and the magnetic field of the storage ring brings them apart from the equilibrium trajectory where they are detected "on-coincidence" by a system of counters. Masses of psi and psi' mesons are determined by applying this technique. Determination has been exercised by detection of e^+e^-→hadrons process in the range of psi resonance. Data on the dependence of beam energy on day temperature fluctuations in the storage tunel have been obtained in the experiment, that has been specified by introducing an additional error common for all the cycles. The following sources of systematic errors have been also analyzed: asymmetric relatively to accelerating resonator position of the detector and depolarizer, presence of electric fields in the storage ring, theoretical inaccuracy of radiation corrections. It is proved that storage ring can be used for conducting precise experiments.

8365 (LBL—15983) **Cryogenically cooled broad-band GaAs field-effect transistor preamplifier.** Lo, C.C.; Leskovar, B. (Lawrence Berkeley Lab., CA (USA)). Oct 1983. Contract AC03-76SF00098. 9p. (CONF-831015—29). NTIS, PC A02/MF A01. Order Number DE84004166.

From Nuclear science symposium; San Francisco, CA, USA (19 Oct 1983).

The Antiproton Source of the Fermi National Accelerator Laboratory will be capable of accumulating a total of 4.3 x 10^{11} antiprotons in four hours when a wide-band feedback system for stochastic beam cooling is used. The feedback system detects and corrects at every revolution, the statistical fluctuations of the beam position and momentum. One of the essential components of such a system is a low-noise broad-band preamplifier. Acryogenically cooled 1 to 2 GHz low-noise broad-band prototype preamplifier utilizing GaAs field-effect transistors is described for this application. The preamplifier has an average gain of 30 dB and 35 dB at ambient temperatures of 293°K and 18°K, respectively. The noise figure has a minimum value of 0.75 dB at 300°K and 0.24 dB at 18°K. The optimum preamplifier operating conditions for a minimum noise figure at temperatures of 293°K, 80°K and 18°K are given and are discussed. Also, the phase-shift characteristics, the input and output voltage standing-wave ratio as a function of frequency and intermodulation products content as a function of the input power level were measured.

8366 (LBL—16744) **Report of the Storage Ring Design Group.** Peterson, J.M.; Sessler, A.M. (Lawrence Berkeley Lab., CA (USA)). Oct 1983. Contract AC03-76SF00098. 12p. (CONF-8309118—5). NTIS, PC A02/MF A01. Order Number DE84004627.

From Topical meeting on free electron generation of extreme ultraviolet coherent radiation; Upton, NY, USA (19 Sep 1983).

The Storage Ring Design Group set itself the tasks of (1) agreeing on the basic formulas with which one designs (conceptually) a Free Electron Laser (FEL) ring, (2) making three examples employing these formulas, and (3) studying the performance of these rings under the assumption that they have been built and that there are operating parameters that can be varied. The study group made good progress on Task No. 1, and the work is described in Section I. We had time under Task No. 2 to produce only one example and this is described in Section II. The group was unable to attack Task No. 3 in the limited time which we had available. However, the subject is of sufficient interest that the two of us, and C. Pellegrini, intend to go on and do a more extensive job on Task No. 2 and some work on Task No. 3, with the thought that out of this survey will come some generally interesting conceptual designs for FEL rings. Although this group was able to produce only one example, it was a most interesting example. We have shown that a FEL ring designed for 500 Angstroms lasing appears to be within the capabilities of storage ring builders.

8367 (LBL—16835) **High energy nuclear beams at Berkeley: present and future possibilities.** Schroeder, L.S. (Lawrence Berkeley Lab., CA (USA)). Sep 1983. Contract AC03-76SF00098. 13p. (CONF-8309168—4). NTIS, PC A02/MF A01. Order Number DE84004173.

From 3. international conference on ultra-relativistic nucleus-nucleus collisions; Upton, NY, USA (26 Sep 1983).

A brief description of the Bevatron is given, and plans for the Relativistic Nuclear Collider (RNC) are described. The RNC would utilize the SuperHILAC as the heavy ion injector and two superconducting storage rings to produce colliding heavy ion beams. (WHK)

8368 (SLAC-CN—256) **Beam-dump kicker magnets.** Bulos, F.; Odian, A.; Tomlin, B. (Stanford Linear Accelerator Center, CA (USA)). 12 Dec 1983. Contract AC03-76SF00515. 14p. NTIS, PC A02/MF A01. Order Number DE84004250.

The beam-dump kicker magnets are located in the final focus region and, in conjunction with septum magnets, extract the beams after they have passed the interaction point (IP) and direct them to their respective dumps. Two schemes for these kickers have been under consideration; ferrite transmission line magnets utilizing technology common with damping rings and positron target kickers, and current loop magnets which are possible only for the dump kickers, where the rise time of the magnetic pulse can be comparatively longer; approximately 400 nanoseconds as compared with 50 nanoseconds for the others. A prototype ferrite kicker has been built and is undergoing tests. Since the current loop requires lower voltage and power plus some additional savings in cost, we decided to build and test a prototype. This note describes in detail an optimized design for the current loop magnets and their associated pulse circuitry.

44 INSTRUMENTATION

4401 Radiation Instrumentation

REFER ALSO TO CITATION(S) 7191, 7625, 7626, 8063, 8124, 8499, 8504, 8528, 8557, 8585

8369 (AD-A—131238/8) **New method in elementary particle detection. Final report, 1 January 1981-31 December 1982.** Weber, J. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy). Feb 1983. 41p. NTIS, PC A03/MF A01.

A general theory of coherent scattering is presented. Applications for very low energy involving the neutral current interactions are considered in detail, together with results of experimental checks.

8370 **(CAPE—2924) Development report: RADIAC systems for measuring aqueous tritium concentration by the liquid scintillation method (Engineering Materials).** (Oak Ridge National Lab., TN (USA)). 14 Nov 1980. Contract W-7405-ENG-26. TIC, PO Bx 62, Oak Ridge, TN 37831.

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This report describes a RADIAC (Radiation Detection, Indication, and Computation) unit to measure aqueous tritium activity in urine or water. The design is based on a room temperature liquid scintillation counting system, and the design criteria specify that it must measure tritium concentrations from 1 to 5 μCi/L in water or urine samples within 20% uncertainty and concentrations above 5 μCi/L within 10% uncertainty. The bench-scale unit constructed for this study consists of two RCA 4501 photomultiplier tubes (PMTs), amplifiers (designed in-house), discriminators, coincidence gates, and a PMT balance circuit. A microprocessor was incorporated into the system to collect, process, and transmit data and to interact with the operator, minimizing the work load and thereby reducing the chance of operator-induced error. The microprocessor performs various sophisticated calculations such as quench curve correction, actual sample activity, and statistical accuracy of data. Because the microprocessor relays each instruction to the operator, the operation of the system is very simple and straightforward. As the operator complies with each instruction, the instrument automatically performs the required task and either presents the results or gives the next instruction. These drawings accompany report No. DOE/NBM--4001927.

8371 **(EGG-HS—6378) Portal monitor evaluation and test procedure.** Johnson, L.O.; Gupta, V.P.; Stevenson, R.L.; Rich, B.L. (EG and G Idaho, Inc., Idaho Falls (USA)). Oct 1983. Contract AC07-76ID01570. 67p. NTIS, PC A04/MF A01. Order Number DE84004948.

The purpose was to develop techniques and procedures to allow users to measure performance and sensitivity of portal monitors. Additionally, a methodology was developed to assist users in optimizing monitor performance. The two monitors tested utilized thin-window gas-flow proportional counters sensitive to beta and gamma radiation. Various tests were performed: a) background count rate and the statistical variability, b) detector efficiency at different distances, c) moving source sensitivity for various size sources and speeds, and d) false alarm rates at different background levels. A model was developed for the moving source measurements to compare the experimental data with measured results, and to test whether it is possible to adequately model the behavior of a portal monitor's response to a moving source. The model results were compared with the actual test results. A procedure for testing portal monitors is also given. 1 reference, 9 figures, 8 tables.

8372 **(IFVE-OEA—82-140) Information sevice organization in the COSDES system.** Ivanov, Yu.N.; Ivanova, N.S.; Klyukhin, V.I.; Luk'yantsev, A.F.; Maksimov, G.M.; Maksimova, R.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1982. 9p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704195.

Described is the organization of information servicing in the COSDES system intended for controlling the operation of scanning measuring projectors when processing the photographs obtained from bubble chambers. The system is designed for operation on-line with the DEC-10 computer. The information servicing in the COSDES system implies the formation of tasks on the film processing for each projector connected to the system, provision of the operator accompanying programs (AP) with input information on the photograph (frame) processed, recording of the operator and AP working results on a magnetic tape and preparation of the entries for the data file, acquisition of statistical data on the work of operators, projectors and real-time system.

8373 **(INIS-BR—61) Electret dosemeter for beta radiation.** Campos, L.L.; Caldas, L.V.E.; Mascarenhas, S. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil); Sao Paulo Univ., Sao Carlos (Brazil). Inst. de Fisica e Quimica). [nd]. 6p. (In Portuguese). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83703958.

The response characteristics of an electret dosemeter for beta radiation are studied. Experiments were performed using different geometries and walls, and it was verified for which geometry the dosemeter sensitivity is greater. Sources of ^{90}Sr - ^{90}Y, ^{204}Tl and ^{85}Kr were used in the experiments.

8374 **(INIS-mf—8233) Investigation of quenching and of the distortion of β spectra occurring in the measuring process when liquid scintillation counters are used.** Renner, H. (Bochum Univ. (Germany, F.R.). Abt. Physik und Astronomie). 16 Dec 1981. 108p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE83703959.

For quenches about 30 organic substances are used which are added to liquid scintillators on the basis of toluol/PPO and dioxan/naphtalene/PPO. From a model a modified Stern-Volmer equation is derived governing all quenchers. For investigation of the problem of chemical quenching the energy spectra of ^{14}C-n-hexadecane is used. It is assumed that for ^{32}P, ^{3}H, and possibly ^{187}Re similar results may be obtained.

8375 (INIS-mf—8299, pp 31-32) **Q3D magnetic spectrograph.** Brauner, M.; Gyufko, R.; Lauer, G.; Schwan, A.; Steck, M.; Thornton, S.T.; Wiedner, C.A. 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

The Q3D spectrogrpah received beam time in 49 shifts of 8 hours concentrated in May and November. During the summer the beam line has been upgraded. The new 26° bending magnet has been inserted. Major realignment of the beam magnets was necesary and a new optical mode had to be adopted to obtain maximum transmission for a 1.5 x 2.5 mm beam spot at the target. The parallel plate detector for the focal plane is ready for time-of-flight measurements, which yield better mass identification and no further necessity of the multipole correction of the kinematic broadening. The doubly gridded ionisation detector with position and angle readout has been tested in the focal plane and is nearing completion. A light ion detector is under development. The Nuclear Data 6660 computer has been equipped with an 80 Mbyte fixed disk. Data analysis, on- and off-line, is thus greatly facilitated.

8376 (INIS-mf—8299, pp 32-33) **Charge resolution of CR-39 plastic track detectors.** Grabez, B.; Vater, P.; Beckmann, R.; Brandt, R.; Hirdes, D. (Marburg Univ. (Germany, F.R.). Fachgebiet Kernchemie). 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

We investigated the possibility of identifaction of low-energy fragments produced in nuclear interactions by measurement onto the finished tracks in CR-39 plastic track detector. Our results show that very good charge resolution can be achieved by determination of mean etch rate ratio and range of low energy ions.

8377 (INIS-mf—8299, pp 33-34) **Modification of the anticoincidence time-of-flight spectrometer.** Butsch, R.; Beck, B.; Hlawatsch, G.; Pochodzalla, J.; Rabe, H.J.; Rosner, G. 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

The sliding seal chamber at the anticoincidence time-of-flight spectrometer was replaced by a new one. Its diamter was enlarged to 56 cm and the five openings (18 x 32 cm^2) where the coincidence counters could be mounted cover an angular range of 220 degrees. The chamber can be rotated within a range of 110 degrees.

8378 (INIS-mf—8299, pp 35-36) **New detector system for heavy ion reactions based on the method of kinematical coincidences.** Betz, J.; Bock, J.; Buehler, M.; Graef, H.; Gorks, A.; Lynen, U.; Novotny, R.; Pelte, D.; Traxel, K.; Weissmann, B. 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

A new arrangement for kinematical coincidence experiments has been built. The arrangement consists of two large, position-sensitive ionization chambers with one parallel-plate detector in front. Each ionization chamber covers a solid angle of 120 msr. In order to measure light-particle multiplicities the target area is surrounded by 20 plastic detectors which cover a solid angle of 9.7 sr.

8379 (INIS-mf—8299, pp 36-37) **Energy resolving scintillation hodoscope to study the production of light particles in heavy ion collisions.** Lindl, B.; Ho, H.; Wurm, J.P. 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

A plastic hodoscope to measure the production of light particles in heavy-ion collisions has been built. The hodoscope displays good time resolution (127 ps for 23 MeV α particles) and high counting rate stability (up to 125 KHz for 90 MeV α particles). Particle energies are derived from time of flight and show good reproducibility. The energy resolution is typically 4% for α particles of 12 to 23 MeV, and 8% for 80 MeV α particles.

8380 (INIS-mf—8299, pp 37-38) **CAMAC control at the multicoincidence chamber.** Muffler, R.; Pfoh, A. 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

Remote control of the target ladder, the goniometer, the "gocarts," and the detector biases via a touch panel has been installed.

8381 (INIS-mf—8299, pp 38-42) **Crystal ball spectrometer.** Adelberger, E.; Lazzarini, A. (Washington Univ., Seattle (USA). Nuclear Physics Lab.); Albrecht, R.; Kolb, B.; Simon, R.S. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)); Fischer, R.D.; Kuehn, W.; Muehlhans, R.; Metag, V. (Giessen Univ. (Germany, F.R.). 2. Physikalisches Inst.); Habs, D. 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

The parameters measured in crystal ball experiments and their resolutions are discussed. Th γ line shapes for individual detectors are shown for different gating conditions. The total energy and multiplicity resolution of the crystal ball are studied as a function of γ-ray multiplicity. While the multiplicity is strongly correlated with the magnitude of the spin in a fusion reaction, the direction of the spin can be determined on an event-by-event basis from the γ-ray angular distribution with a resolution of +- 35°. The crystal ball also has a large sensitivity to neutrons, allowing the simultaneous measurement of neutron multiplicities.

8382 (INIS-mf—8299, pp 42-44) **High resolution spectroscopy of low energy conversion electrons.** Bosch, F.; Kozhuharov, C.; Mann, R.; Mokler, P.H. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)); Koenig, W.; Martin, B.; Soltani, J. 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

At heavy ion accelerators, conversion electron spectroscopy offers the possibility of investigating few- or even one-electron projectiles with atomic numbers around Z = 60 at Esub(ion) = 20 MeV/u. By this method K-shell binding energies can be obtained with an accuracy of $\Delta E_{sub}(B)/E_{sub}(B) = 10^{-5}$, allowing the study of QED effects such as self-energy or vacuum polarization.

8383 (INIS-mf—8299, pp 57) **Report of the service group.** Ochmann, G.; Burkert, E.; Berger, R.; Heibel, W.; Lackner, R.; Pilz, W.; Schmidsberger, P.; Kaiser, P.; Toepper, F. 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

The activities have been in the fields of service, printed circuits, design and fabrication of analog and digital devices, and assisting scientific projects in nuclear physics and cosmophysics.

8384 (INIS-mf—8299, pp 57) **Electronics for nuclear reaction experiments.** Hornung, M.; Bulian, N.; Pelikan, P.; Holoch, R.; Roedel, R. 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

The main activities have been in the fields of development and fabrication of nuclear electronics.

8385 (INIS-mf—8299, pp 58-59) **Electronics for space research.** Linkert, D.; Baust, G.; Hofacker, R.; Matt, G.; Schneider, W.; Tietz, H.; Voth, H.; Zahlten, A. 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

Work on the Dust Detector Subsysteme at the Galileo project and the International Solar Polar Mission is continued. The work on the particulate impact analyzer for the Giotto Mission has been started. A Galileo 2 Mission to Saturn is in preparation.

8386 (INIS-mf—8299, pp 57-58) **Modular 10 x 16 bit input register with encoding of addresses.** Bulian, N.; Knoepfle, K.T. 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

A linked array of ten 16-bit input registers, each with a double pulse resolution of 10 nsec and an address encoding time of 180 nsec, provides according to the 160-bit input pattern a fast trigger signal and the encoded 9-bit address at a 3 MHz rate.

8387 (INIS-mf—8299, pp 58) **Service of online computers.** Nouvel, P.; Dreiss, D.; Heck, U.; Menzer, R.; Thiel, P. 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

8388 (INIS-mf—8299, pp 59-60) **Computer center.** Black, I.; Heusler, A.; Hoeptner, G.; Lang, R.; Moelenkamp, R.; Mueller, W.; Mueller, W.F.; Schati, C.; Schmidt, A.; Schwind, D. 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

Due to a disaster in the air-conditioning plant in March, the DEC10 was partially replaced by a new system in September. In November the repaired and the new parts of the system functioned with the previous reliability.

8389 (INIS-mf—8299, pp 61) **Data reduction with the VAX computers FRANNY and ZOOEY.** Essel, H.G. 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

The first VAX-780 has been expanded to its maximum capabilities. A second VAX computer has been working since August 1982. The data analysis system DARSY is being tested.

8390 (INIS-mf—8299, pp 61-62) **Heidelberg POLYP.** Albrecht, C.; Deluigi, B.; Maenner, R.; Rausch, A.; Saaler, W.; Walter, P. v. 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

The multiprocessor properties of the POLYP system were first tested in spring 1982. With the aid of a software-controlled unit, the error-correction part of the bus protocols has been examined for correctness. During the summer the third generation of basic modules was designed; they provide all previously proposed features and will be used in several applications. The 10 MHz processor board and static and dynamic memory are completely tested. Under test are the interprocessor link and a cache money. DMA controllers to the Fastbus and Unibus are under development.

8391 (INIS-mf—8299, pp 62) **Fast data acquisition system for the crystal ball spectrometer.** Maenner, R. (Heidelberg Univ. (Germany, F.R.)); Himmele, G. 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

The status and development of the data acquisition and analysing system for the crystal ball in connection with the multimicroprocessor system POLYP is described.

8392 (INIS-mf—8536, pp 63) **Neutron radiography with photographic film detectors.** Chalot, J.F.; Altamirano, J.; Segovia, N. (Instituto Nacional de Investigaciones Nucleares, Mexico City); Monnin, M. (Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires). 1982. (In Spanish). NTIS (US Sales Only), PC A05/MF A01. (CONF-820958—Summ.).

From 4. symposium on nuclear chemistry, radiochemistry and radiation chemistry; Mexico City, Mexico (7 Sep 1982).

Published in summary form only.

8393 (INIS-mf—8584, pp 23-28) **Natural radiation field and problems of dosimetry.** Spurny, Z. (Ceskoslovenska Akademie Ved, Prague. Ustav Dozimetrie Zareni). [nd]. (In Czech). NTIS (US Sales Only), PC A09/MF A01. (CONF-8105231—).

From Conference on nucleonic instruments and their use in the CSSR; Pribram, Czechoslovakia (18 May 1981).

The problems are discussed of dosimetry of the natural radiation field. A brief description is shown of the most important properties of the natural radiation field, this both time independent (local differences and spectral complexity) and time dependent (meteorological and astrophysical effects). Own experience and recommendations regarding a dosimetry instrument are submitted. The sensitivity of a dosimetry instrument for monitoring radioactive purity of the living environment should be optimal rather than maximal, this also with respect to the practically lowest dose rates measurable in the controlled area.

8394 (INIS-mf—8584, pp 83-88) **Current state of development of radioactivity standards.** Kokta, L.; Plch, J.; Jasanovsky, P.; Dryak, P.; Kits, J. (Ustav pro Vyzkum, Vyrobu a Vyuziti Radioisotopu, Prague (Czechoslovakia)). [nd]. (In Czech). NTIS (US Sales Only), PC A09/MF A01. (CONF-8105231—).

From Conference on nucleonic instruments and their use in the CSSR; Pribram, Czechoslovakia (18 May 1981).

The range of radioactivity standards (according to UVVVR Catalogue of Standards) comprises 60 different radionuclides and is completed or changed as required by the needs of the national economy. The basic type is the ER Standard, the aqueous solution of a suitable chemical form of the radionuclide. Newly introduced standards called type EFS, are produced containing the radionuclides ^{57}Co, ^{139}Ce, ^{203}Hg, ^{85}Sr, ^{137}Cs, ^{54}Mn, ^{60}Co, ^{85}Y, ^{133}Ba, ^{152}Eu, ^{56}Co. Other standards being introduced include carrier-free standard solutions of radionuclides, alpha, beta, X and gamma standard foils, standards of the gaseous forms of ^{3}H, ^{85}Kr, ^{131}I, ^{133}Xe, a set of large-area standards with ^{90}(Sr+Y) and large-area standards of beta series radionuclides of high metrological value.

8395 (INIS-mf—8584, pp 127-137) **Determining dose equivalent rate and other neutron radiation characteristics by NB 52U1 and NB 5201A monitors.** Severa, L.; Fueloep, M.; Gregor, J.; Kula, J. (Tesla, Premysleni (Czechoslovakia). Vyzkumny Ustav Pristroju Jaderne Techniky). [nd]. (In Czech). NTIS (US Sales Only), PC A09/MF A01. (CONF-8105231—).

From Conference on nucleonic instruments and their use in the CSSR; Pribram, Czechoslovakia (18 May 1981).

Neutron monitors NB 5201 and NB 5201A are portable radiometric instruments for monitoring reactor, accelerator and neutron generator sites and the immediate vicinity of isotope sources for the purposes of personnel protection. They use the principle of neutron moderation and are individually calibrated using a ^{241}Am-Be source whose neutron flux was determined with an accuracy of +-2%. The design of the monitors is described. In addition to the evaluation of dose equivalent in the range of about 0.01 mSv/h to 100 mSv/h for neutron energies from 0.025 eV to 14 MeV, the NB 5201A monitor allows determining the physical characteristics of neutrons at a chosen point, ie., the dose rate, kerma and fluence. The monitor specifications are given. Series production is to be started in 1982.

8396 (INIS-mf—8584, pp 270-273) **Instrument for measurement of low ionization chamber currents.** Novotny, J.; Jirousek, P.; Vavra, S. (Ceskoslovenska Akademie Ved, Prague. Ustav Dozimetrie Zareni). [nd]. (In Czech). NTIS (US Sales Only), PC A09/MF A01. (CONF-8105231—).

From Conference on nucleonic instruments and their use in the CSSR; Pribram, Czechoslovakia (18 May 1981).

The compensation method was used in designing the measuring instrument. The current being measured is compensated with charging current of the measuring capacitor and can be determined from the formula $i=C.\Delta U/\Delta t$. ΔU is determined using a pair of comparators adjusted to preset levels U_1 and U_2, triggered and stopped by a quartz stop watch. A measuring resistor can be used in place of the measuring capacitor and voltage can be measured without using the stop watch. The said instrument allows measuring ionizing currents exceeding 0.01 pA at an overall inaccuracy lower than 1%.

8397 (INIS-mf—8584, pp 41) **Choice of detection unit for low level gamma counting.** Novakova, O.; Vierebl, L.; Gilar, O.; Dvorak, V.; Jursova, L.; Smola, J. (Tesla, Premysleni (Czechoslovakia). Vyzkumny Ustav Pristroju Jaderne Techniky). [nd]. (In Czech). NTIS (US Sales Only), PC A09/MF A01. (CONF-8105231—).

From Conference on nucleonic instruments and their use in the CSSR; Pribram, Czechoslovakia (18 May 1981).

Published in summary form only.

8398 (INIS-mf—8584, pp 55-56) **Possible applications of neutron and gamma dose ratemeter NDK-601 in radiation protection.** Nikodemova, D. (Vyskumny Ustav Preventivneho Lekarstva, Bratislava (Czechoslovakia)); Severa, L. (Tesla, Premysleni (Czechoslovakia). Vyzkumny Ustav Pristroju Jaderne Techniky). [nd]. (In Slovak). NTIS (US Sales Only), PC A09/MF A01. (CONF-8105231—).

From Conference on nucleonic instruments and their use in the CSSR; Pribram, Czechoslovakia (18 May 1981).

Published in summary form only.

8399 (INIS-mf—8584, pp 57-60) **Instrumentation for study of selected integral solid-state dosimetric methods.** Musilek, L.; Kluson, J.; Darickova, A. (Ceske Vysoke Uceni Technicke, Prague (Czechoslovakia). Fakulta Jaderna a Fysikalne Inzenyrska). [nd]. (In Czech). NTIS (US Sales Only), PC A09/MF A01. (CONF-8105231—).

From Conference on nucleonic instruments and their use in the CSSR; Pribram, Czechoslovakia (18 May 1981).

Requirements are compared on instrumentation for the evaluation of thermoluminescence, lyoluminescence and the measurement of radiation induced thermally activated currents. The block diagrams of the individual evaluation systems consisting of picoammeters, x-y recorders and possibly photomultipliers are remarkably similar.

8400 (INIS-mf—8584, pp 61-66) **Comparison of LKB Wallac-Multigamma 1260 multidetector instrument with other instruments for gamma sample measurement.** Dolezal, L. (Palackeho Univ., Olomouc (Czechoslovakia). Prirodovedecka Fakulta); Husak, V.; Erban, J. (Fakultni Nemocnice, Olomouc (Czechoslovakia). Oddeleni Nuklearni Mediciny). [nd]. (In Czech). NTIS (US Sales Only), PC A09/MF A01. (CONF-8105231—).

From Conference on nucleonic instruments and their use in the CSSR; Pribram, Czechoslovakia (18 May 1981).

The Multigamma 1260 consists of 12 well-type NaI(Tl) scintillation crystals shielded with a 10 mm thick lead block. It is microprocessor controlled. Its energy range is 10 to 800 keV. The instrument allows measuring 660 samples per hour at a measurement time of 1 min. Efficiency for ^{125}I detection is minimally 75%. A comparison was made with counters Searle 4227 (100 samples) and

Searle 1185 (300 samples) whose operating schedule is much slower. Long-term and short-term stabilities of the instruments and its volume dependence for ^{125}I were tested.

8401 (INIS-mf—8584, pp 67-70) **Measurement and evaluation of detection parameters of scintillation camera.** Husak, V.; Erban, J.; Wiedermann, M. (Fakultni Nemocnice, Olomouc (Czechoslovakia). Oddeleni Nuklearni Mediciny); Kleinbauer, K.; Ullmann, V. (Krajsky Ustav Narodniho Zdravi, Ostrava (Czechoslovakia)). [nd]. (In Czech). NTIS (US Sales Only), PC A09/MF A01. (CONF-8105231—).

From Conference on nucleonic instruments and their use in the CSSR; Pribram, Czechoslovakia (18 May 1981).

Information is submitted on the methods and conditions of measurement of detection parameters of a scintillation camera (position resolution, detection field homogeneity, linearity, sensitivity, dead time, and energy resolution). The study is intended as a draft of the unified testing of correct operation of scintillation cameras used in the CSSR.

8402 (INIS-mf—8584, pp 71-73) **Resulting parameters of whole-body profilograph with TESLA evaluation system.** Silar, J. (Karlova Univ., Prague (Czechoslovakia). Biofyzikalni Ustav). [nd]. (In Czech). NTIS (US Sales Only), PC A09/MF A01. (CONF-8105231—).

From Conference on nucleonic instruments and their use in the CSSR; Pribram, Czechoslovakia (18 May 1981).

Two-channel instrument TESLA NZG 702 with recorder NOZ 722 and TESLA NZG 312 T for automatic digital recording of summated pulse rates were used in testing the operation of a three-way whole-body profilograph with NaI(Tl) scintillation detectors. Tested were the collimation characteristics of the individual profilograph pathways in integral and photopeak operating modes and the profilograph parameters with detectors in summation connection.

8403 (INIS-mf—8584, pp 78) **Semiconductor detector instruments for X-ray fluorescence analysis.** Lozek, P. (Ceskoslovenska Komise pro Atomovou Energii, Prague); Benada, J. (Ustav Nerostnych Surovin, Kutna Hora (Czechoslovakia)). [nd]. (In Czech). NTIS (US Sales Only), PC A09/MF A01. (CONF-8105231—).

From Conference on nucleonic instruments and their use in the CSSR; Pribram, Czechoslovakia (18 May 1981).

Published in summary form only.

8404 (INIS-mf—8584, pp 79-80) **Directional scintillation detection unit.** Dohnal, J. (Zakladna Rozvoje Uranoveho Prumyslu, Ostrov nad Ohri (Czechoslovakia). Zavod Mechanizace a Automatizace). [nd]. (In Czech). NTIS (US Sales Only), PC A09/MF A01. (CONF-8105231—).

From Conference on nucleonic instruments and their use in the CSSR; Pribram, Czechoslovakia (18 May 1981).

Published in summary form only.

8405 (INIS-mf—8584, pp 89-93) **Czechoslovak-made photomultipliers.** Raus, J. (Tesla, Prague (Czechoslovakia)). [nd]. (In Czech). NTIS (US Sales Only), PC A09/MF A01. (CONF-8105231—).

From Conference on nucleonic instruments and their use in the CSSR; Pribram, Czechoslovakia (18 May 1981).

The photomultipliers comprise multi-alkali or bi-alkali photocathodes (types Sb-K-Cs and Sb-Na-K) and box and venetian-blind multiplier systems. The dynodes consist of either a AgMg alloy or an antimony-cesium emitter on a nickel backing. The system is described by photomultiplier designations set by Czechoslovak standards. The specifications are shown in a table of Czechoslovak photomultipliers.

8406 (INIS-mf—8584, pp 94-101) **Waterproof detection units.** Markova, H.; Svobodova, B.; Novakova, O.; Pavlicek, Z. (Tesla, Premysleni (Czechoslovakia). Vyzkumny Ustav Pristroju Jaderne Techniky). [nd]. (In Czech). NTIS (US Sales Only), PC A09/MF A01. (CONF-8105231—).

From Conference on nucleonic instruments and their use in the CSSR; Pribram, Czechoslovakia (18 May 1981).

The waterproof detection units are produced in two variants. Types ND 3501 A, ND 3501 B consist of a Tescint (NaI(Tl) scintillator with photomultiplier 61 PK 503) and a high voltage divider. They only differ in the length of the high voltage coaxial cable VLEOY 50-2.95 which can be supplied in lengths of 2 and 10 meters. Type ND 3502 comprises an additional ^{241}Am radionuclide. White silicon rubber is used as a reflector.

8407 (INIS-mf—8584, pp 102-122) **Detection units for low level gamma counting NE 3502A,B and NE 3503.** Novakova, O.; Jursova, L.; Frystacka, L.; Gilar, O. (Tesla, Premysleni (Czechoslovakia). Vyzkumny Ustav Pristroju Jaderne Techniky). [nd]. (In Czech). NTIS (US Sales Only), PC A09/MF A01. (CONF-8105231—).

From Conference on nucleonic instruments and their use in the CSSR; Pribram, Czechoslovakia (18 May 1981).

The NE 3502 A,B detection unit is based on scintillation probe NS 9501. It consists of photomultiplier 67 PK 512 and a NaI(Tl) single crystal of the SKG 1S UO5 type. Energy resolution for ^{137}Cs is 7 to 8%. Operating voltage is 800 to 2000 V. The detector and the probe are mounted in an annular lead shielding of 70 to 120 mm in thickness which secures a low background value. The whole unit is mounted on a trolley allowing the movement of the detection unit at a maximum speed of 3 $km.h^{-1}$. Detection unit NE 3503 consists of scintillation probe NS 9501 with scintillation detector SKG 1S N20. The detector, probe and flow vessel are placed in a 70 mm thick lead shielding. The assembly is attached with bolts to an immobile rack and is covered with a steel sheet. The annular configuration of the detector and the sample to be measured ensures high sensitivity of the detection unit.

8408 (INIS-mf—8584, pp 123-126) **^{6}LiI(Eu)-based scintillation detector for dose equivalent rate monitor.** Novakova, H.; Svobodova, B.; Pavlicek, Z. (Tesla, Premysleni (Czechoslovakia). Vyzkumny Ustav Pristroju Jaderne Techniky). [nd]. (In Czech). NTIS (US Sales Only), PC A09/MF A01. (CONF-8105231—).

From Conference on nucleonic instruments and their use in the CSSR; Pribram, Czechoslovakia (18 May 1981).

The specifications are given of a scintillation detector being developed for neutron detection in a mixed n-gamma field, type designation SKN 6 NO2 A. The detector operates in cooperation with scintillation probe NKQ 302 and output signals are processed by evaluation equipment NZZ 302. An encased ^{6}LiI(Eu) monocrystal is placed in a cylindrical lightguide hollow. The optical contacts lightguide-scintillation detector window and lightguide-photomultiplier photocathode are from silicon rubber. A two-part lightproof case from a black rigid plastic is integral part of the SKN 6 NO2 A detector. The scintillation detector performance is affected by the purity of initial raw materials and by the quality of organic glass lightguide.

8409 (INIS-mf—8584, pp 138-156) **Portable counter NA 3201.** Slezak, V.; Trpak, J.; Viererbl, L.; Novakova, O.; Kula, J. (Tesla, Premysleni (Czechoslovakia). Vyzkumny Ustav Pristroju Jaderne Techniky). [nd]. (In Czech). NTIS (US Sales Only), PC A09/MF A01. (CONF-8105231—).

From Conference on nucleonic instruments and their use in the CSSR; Pribram, Czechoslovakia (18 May 1981).

The NA 3201 evaluation unit is designed for measuring radioactivity of solid, loose and mainly liquid samples. It consists of three-channel spectrometric unit NV 3201, power supply NJ 3221 and detection unit NE 3501. Variants are discussed obtained by different interconnection of the said units and possibly other modules. The meter specifications and the description of the units are presented.

8410 (INIS-mf—8584, pp 157-166) **NRR 610 automatic alpha beta counter.** Vorlicek, J.; Temml, P.; Smola, J.; Javornicky, K.; Novak, J.; Polacek, V. (Tesla, Premysleni (Czechoslovakia). Vyzkumny Ustav Pristroju Jaderne Techniky). [nd]. (In Czech). NTIS (US Sales Only), PC A09/MF A01. (CONF-8105231—).

From Conference on nucleonic instruments and their use in the CSSR; Pribram, Czechoslovakia (18 May 1981).

Laboratory instrument NRR 610 was developed for measuring very low alpha and beta activities of flat solid samples. A description of the instrument and its specifications are given.

8411 (INIS-mf—8584, pp 167-176) **NA 6201 low level alpha-beta counter.** Novakova, O.; Slezak, V.; Smola, J.; Jursa, P.; Kula, J. (Tesla, Premysleni (Czechoslovakia). Vyzkumny Ustav Pristroju Jaderne Techniky). [nd]. (In Czech). NTIS (US Sales Only), PC A09/MF A01. (CONF-8105231—).

From Conference on nucleonic instruments and their use in the CSSR; Pribram, Czechoslovakia (18 May 1981).

The NA 6201 counter consists of two parts. The detection part consists of two detection units, lead shielding, a sample changer and a pressure cylinder with working gas (CH_4). The POB 302 through-flow gas counter is used as the main channel detector. A scintillation detection unit is placed underneath the detector. The other part, an electronic evaluation system, features a modular design and consists of the Almes system. The counter block diagram and specifications are presented. The counter is designed for very low alpha and beta activity counting of flat samples. It guarantees reliable sample measurement of gross alpha or beta activity of 0.03 Bq at a measuring time of 2 hours. It is suitable for monitoring the contamination of food, soils, drinking water and waste water, but also for determining natural radioactivity of materials.

8412 (INIS-mf—8584, pp 212-216) **Feasibility of low-energy gamma detection by scintillation detector.** Vasek, T.; Dvorak, V. (Tesla, Premysleni (Czechoslovakia). Vyzkumny Ustav Pristroju Jaderne Techniky). [nd]. (In Czech). NTIS (US Sales Only), PC A09/MF A01. (CONF-8105231—).

From Conference on nucleonic instruments and their use in the CSSR; Pribram, Czechoslovakia (18 May 1981).

A single-window automatic gamma counter was developed for measurement and evaluation of low-level ^{125}I-labelled samples. A 45 mm diameter by 50 mm thick NaI(Tl) crystal was chosen for an estimated sample volume of 5 cm^3. The performance of the instrument was investigated using specimens of cross-bored scintillation detectors.

8413 (INIS-mf—8584, pp 217-222) **Optimal selection of discrimination levels in radionuclide activity measurement.** Viererbl, L. (Tesla, Premysleni (Czechoslovakia). Vyzkumny Ustav Pristroju Jaderne Techniky). [nd]. (In Czech). NTIS (US Sales Only), PC A09/MF A01. (CONF-8105231—).

From Conference on nucleonic instruments and their use in the CSSR; Pribram, Czechoslovakia (18 May 1981).

The selection is discussed of analyzer discrimination levels in measuring radionuclide activity with a scintillation detector using the wide-channel or integral evaluation method. The requirement that the mean square error of the measured activity value should be minimal was considered to be the criterion for discrimination level selection. Test measurements showed that with the optimal adjustment, the discrimination levels are practically independent of activity for a considerable activity range.

8414 (INIS-mf—8584, pp 223-227) **Properties of large-volume NaI(Tl) gamma spectrometers and its use in modern nuclear physics.** Oblozinsky, P.; Hlavac, S.; Mungyer, S. (Slovenska Akademia Vied, Bratislava (Czechoslovakia). Fyzikalny Ustav). [nd]. (In Slovak). NTIS (US Sales Only), PC A09/MF A01. (CONF-8105231—).

From Conference on nucleonic instruments and their use in the CSSR; Pribram, Czechoslovakia (18 May 1981).

Energy and time resolution, the total efficiency curve and response functions of a 160 mm dia. by 100 mm thick NaI(Tl) detector were studied in an extremely broad energy range of 0.2 to 20 MeV. The results are shown in tables and graphs.

8415 (INIS-mf—8584, pp 228-231) **Effect of point of origin of scintillations in NaI(Tl) crystals on signal pulse height and on energy resolution of scintillation detectors.** Silar, J. (Karlova Univ., Prague (Czechoslovakia). Fakulta Vseobecneho Lekarstvi). [nd]. (In Czech). NTIS (US Sales Only), PC A09/MF A01. (CONF-8105231—).

From Conference on nucleonic instruments and their use in the CSSR; Pribram, Czechoslovakia (18 May 1981).

Measurements confirmed that in NaI(Tl) scintillators whose diameter and height exceed 50 mm the average tracks of luminescence photons are large enough for self-absorption in the crystal material to be manifest. At gamma photon energy exceeding 200 keV, absorption due to Compton scattering prevails in NaI(Tl) crystals. The dependence on the source/detector configuration was measured of the pulse height and energy resolution in detectors consisting of NaI(Tl) crystals 45 mm in dia. and 50 mm thick and 100 mm in dia. and 100 mm thick. The results are tabulated of measuring FWHM and the maximum peak position and the values calculated therefrom of energy resolution for ^{137}Cs and for both crystal dimensions and for collimated and noncollimated radiations.

8416 (INIS-mf—8584, pp 232-235) **Electronic methods of n-γ response separation in organic scintillators.** Gerndt, J. (Ceske Vysoke Uceni Technicke, Prague (Czechoslovakia). Fakulta Jaderna a Fysikalne Inzenyrska). [nd]. (In Czech). NTIS (US Sales Only), PC A09/MF A01. (CONF-8105231—).

From Conference on nucleonic instruments and their use in the CSSR; Pribram, Czechoslovakia (18 May 1981).

The following methods are suitable for resolving scintillation response to gamma radiation and neutrons in small portable instruments: the saturated spatial charge method, the charge comparison method, the Ferte method, the zero passing method, and the direct measurement of the rise time of a photomultiplier integrated current pulse.

8417 (INIS-mf—8584, pp 239-242) **New findings on measurement instability in liquid scintillation spectrometry, due to sample adsorption on cuvette.** Rexa, R. (Univerzita P.J. Safarika, Kosice (Czechoslovakia). Katedra Vseobecnej Biologie); Tykva, R. (Ceskoslovenska Akademie Ved, Prague. Ustav Organicke Chemie a Biochemie). [nd]. (In Slovak). NTIS (US Sales Only), PC A09/MF A01. (CONF-8105231—).

From Conference on nucleonic instruments and their use in the CSSR; Pribram, Czechoslovakia (18 May 1981).

The relationships are analyzed between time changes in pulse rates measured in ^{3}H- and ^{32}P-channels of a liquid scintillation spectrometer for ^{32}P-labelled samples. Time dependence of the changes is studied.

8418 (INIS-mf—8584, pp 243-246) **Liquid scintillators for measuring samples with large water content.** Sramek, M.; Svobodova, B.; Jursova, L.; Pavlicek, Z. (Tesla, Premysleni (Czechoslovakia). Vyzkumny Ustav Pristroju Jaderne Techniky). [nd]. (In Czech). NTIS (US Sales Only), PC A09/MF A01. (CONF-8105231—).

From Conference on nucleonic instruments and their use in the CSSR; Pribram, Czechoslovakia (18 May 1981).

Detection efficiency is evaluated of Czechoslovak-made liquid scintillators in dependence on increased water concentration in the sample being measured. The detection efficiency curves for water addition in Czechoslovak emulsion liquid scintillators and scintillator Unisolve 100 are practically identical and show the same slope. The addition of water does not significantly affect the scintillator detection efficiency.

8419 (INIS-mf—8584, pp 247-252) **Increase by order of magnitude in quality factor during Cherenkov radiation detection in samples on solid carriers in glass cuvettes Kavalier.** Podracka, E. (Institut pro Klinickou a Experimentalni Medicinu, Prague (Czechoslovakia)); Tykva, R. (Ceskoslovenska Akademie Ved, Prague. Ustav Organicke Chemie a Biochemie). [nd]. (In Czech). NTIS (US Sales Only), PC A09/MF A01. (CONF-8105231—).

From Conference on nucleonic instruments and their use in the CSSR; Pribram, Czechoslovakia (18 May 1981).

The method of measuring Cherenkov radiation developed by the authors is discussed based on measuring samples on a solid carrier in glass scintillation cuvettes Kavalier. Increased interaction of emitted beta particles and modified measurement configuration were achieved by putting polyethylene foils of 0.3 mm in thickness

and 17 mm in diameter straight to the sample or inserting a polyethylene tube of 13 mm in length and 15 mm in diameter down to the bottom of the cuvette in whose axis the sample is mounted. The application of the said technique can increase the quality factor by an order of magnitude when Czechoslovak-made cuvettes are used and a significantly higher value of quality factor can be obtained than when peak standard cuvettes imported from abroad and the original Huelsen and Prenzel's procedure are used.

8420 (INIS-mf—8584, pp 253-257) **Development of semiconductor topographic detection using silicon detectors.** Tykva, R. (Ceskoslovenska Akademie Ved, Prague. Ustav Organicke Chemie a Biochemie). [nd]. (In Czech). NTIS (US Sales Only), PC A09/MF A01. (CONF-8105231—).

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8421 (INIS-mf—8584, pp 258-261) **Advances in surface-barrier silicon detectors.** Hanzlik, J.; Tykva, R. (Ceskoslovenska Akademie Ved, Prague. Ustav Organicke Chemie a Biochemie). [nd]. (In Czech). NTIS (US Sales Only), PC A09/MF A01. (CONF-8105231—).

From Conference on nucleonic instruments and their use in the CSSR; Pribram, Czechoslovakia (18 May 1981).

Steps are described contributing to the successful preparation of silicon surface-barrier detectors for the Prognoz-8 satellite, designed for long-term detection of low energy protons and electrons. They include monitoring conditions of possible substrate contamination in the production of AuSiN detectors during chemical polishing and the subsequent operations, and limiting the undesirable effect of forward current flow during electrode depositing.

8422 (INIS-mf—8584, pp 262-265) **Possibilities of selecting low-noise photomultipliers for ^3H detection.** Silar, J. (Karlova Univ., Prague (Czechoslovakia). Fakulta Vseobecneho Lekarstvi); Kvapil, M. (Tesla, Prague (Czechoslovakia)); Novakova, D. (Tesla, Premysleni (Czechoslovakia). Vyzkumny Ustav Pristroju Jaderne Techniky). [nd]. (In Czech). NTIS (US Sales Only), PC A09/MF A01. (CONF-8105231—).

From Conference on nucleonic instruments and their use in the CSSR; Pribram, Czechoslovakia (18 May 1981).

Special photomultipliers with bi-alkali SbKCs photocathode and 13-stage amplifier system were developed for the detection of tritium using liquid scintillators and coincidence photomultiplier systems. The assessment of photocathode quality is completed with the measurement of the photocathode blue sensitivity. Such photomultipliers in which at a temperature of 8 degC and a gain of about 10^7 the product of 1eZ pulse rates does not exceed a value of $1x10^7$ are considered to be a suitable pair of photomultipliers for tritium measurement.

8423 (INIS-mf—8584, pp 266) **Microchannel photomultiplier.** Beranek, I.; Jandus, J. (Tesla, Prague (Czechoslovakia)). [nd]. (In Czech). NTIS (US Sales Only), PC A09/MF A01. (CONF-8105231—).

From Conference on nucleonic instruments and their use in the CSSR; Pribram, Czechoslovakia (18 May 1981).

Published in summary form only.

8424 (INIS-mf—8584, pp 267-269) **Use of microprocessors in dosimetry.** Hudec, L.; Kokes, J. [nd]. (In Czech). NTIS (US Sales Only), PC A09/MF A01. (CONF-8105231—).

From Conference on nucleonic instruments and their use in the CSSR; Pribram, Czechoslovakia (18 May 1981).

A general purpose evaluation and computer unit was developed for measuring ionizing radiation, based on a microcomputer with microprocessor. Arithmetical and logical operations are provided by a 8080A type microprocessor, the microprocessor timing is ensured using an 8224 clock generator in cooperation with a 8228 system controller. Memory blocks, a keyboard and two displays are wired to the CPU. Radiation counters are placed separately.

8425 (INIS-mf—8584, pp 236-238) **Energy dependence of scintillator light yield.** Jakes, J.; Sabol, J. (Ceske Vysoke Uceni Technicke, Prague (Czechoslovakia). Fakulta Jaderna a Fysikalne Inzenyrska). [nd]. (In Czech). NTIS (US Sales Only), PC A09/MF A01. (CONF-8105231—).

From Conference on nucleonic instruments and their use in the CSSR; Pribram, Czechoslovakia (18 May 1981).

Light yield was determined for organic scintillators dihydropyrine, SLI-31, SLX-31, NE 213, KL 360, and KL 501 for proton energies of 0.57 MeV, 2.07 MeV, 5.25 MeV, and 15.1 MeV. The obtained data will allow better use of the scintillators as dose or dose equivalent monitors.

8426 (INIS-mf—8584) **Nucleonic instruments and their use in the CSSR.** Lukac, P.; Pruzinec, J. (Tesla, Premysleni (Czechoslovakia). Vyzkumny Ustav Pristroju Jaderne Techniky). [nd]. 183p. (CONF-8105231—). NTIS (US Sales Only), PC A09/MF A01. Order Number DE84780044.

From Conference on nucleonic instruments and their use in the CSSR; Pribram, Czechoslovakia (18 May 1981).

Selected papers were processed for inclusion in the Energy Data Base.

8427 (INIS-mf—8642, pp 26) **Comparison of properties of spectrometric amplifiers.** Dryak, P.; Kokta, L.; Kovar, P.; Novotna, P.; Hrdlickova, L. (Ustav pro Vyzkum, Vyrobu a Vyuziti Radioisotopu, Prague (Czechoslovakia)). May 1983. (In Czech). NTIS (US Sales Only), PC A04/MF A01. (CONF-8305140—Absts.).

From Conference on instrumental activation analysis - IAA 83; Klucenice, Czechoslovakia (30 May 1983).

8428 (INIS-mf—8642, pp 27) **Gamma spectrometric system Canberra-Jupiter 80 with PDP 11/34A computer at Central Laboratories of the Czechoslovak Uranium Industry - detection and measuring parts.** Kotas, P.; Bouda, T. (Ceskoslovensky Uranovy Prumysl, Straz pod Ralskem. Ustredni Laboratore). May 1983. (In Czech). NTIS (US Sales Only), PC A04/MF A01. (CONF-8305140—Absts.).

From Conference on instrumental activation analysis - IAA 83; Klucenice, Czechoslovakia (30 May 1983).

8429 (INIS-mf—8642, pp 28) **Gamma spectrometric system Canberra-Jupiter 80 with PDP 11/34A computer at Central Laboratories of the Czechoslovak Uranium Industry - computer part.** Bouda, T.; Kotas, P. (Ceskoslovensky Uranovy Prumysl, Straz pod Ralskem. Ustredni Laboratore). May 1983. (In Czech). NTIS (US Sales Only), PC A04/MF A01. (CONF-8305140—Absts.).

From Conference on instrumental activation analysis - IAA 83; Klucenice, Czechoslovakia (30 May 1983).

8430 (INIS-mf—8642, pp 29) **Application of TN-4500 system in gamma spectrometry.** Mayer, J. (Vyzkumny Ustav Hutnictvi Zeleza, Dobra (Czechoslovakia)). May 1983. (In Czech). NTIS (US Sales Only), PC A04/MF A01. (CONF-8305140—Absts.).

From Conference on instrumental activation analysis - IAA 83; Klucenice, Czechoslovakia (30 May 1983).

8431 (INIS-mf—8642, pp 30) **256-channel field spectrometer GS-256.** Bartosek, J.; Fous, A.; Masek, J. (Geofyzika, n.p., Brno (Czechoslovakia)). May 1983. (In Czech). NTIS (US Sales Only), PC A04/MF A01. (CONF-8305140—Absts.).

From Conference on instrumental activation analysis - IAA 83; Klucenice, Czechoslovakia (30 May 1983).

8432 (INIS-mf—8642, pp 31) **Experience with multichannel amplitude analyzer in CAMAC system.** Kapisovsky, V.; Jancik, O.; Bena, J.; Krchnakova, M. (Vyskumny Ustav Jadrovych Elektrarni, Jaslovske Bohunice (Czechoslovakia)). May 1983. (In Slovak). NTIS (US Sales Only), PC A04/MF A01. (CONF-8305140—Absts.).

From Conference on instrumental activation analysis - IAA 83; Klucenice, Czechoslovakia (30 May 1983).

8433 (INIS-mf—8642, pp 32) **Possible applications of TPA-70 minicomputer and CAMAC system in gamma spectrometry.** Szarka, J. (Komenskeho Univ., Bratislava (Czechoslovakia)). May 1983. (In Slovak). NTIS (US Sales Only), PC A04/MF A01. (CONF-8305140—Absts.).

From Conference on instrumental activation analysis - IAA 83; Klucenice, Czechoslovakia (30 May 1983).

8434 (INIS-mf—8642, pp 33) **On-line connection of NTA 1024 multichannel analyzer and JPR 12-R minicomputer.** Podracky, P.; Kleps, J. (Ceskoslovenska Akademie Ved, Prague. Ustav Geologie a Geotechniky). May 1983. (In Czech). NTIS (US Sales Only), PC A04/MF A01. (CONF-8305140—Absts.).

From Conference on instrumental activation analysis - IAA 83; Klucenice, Czechoslovakia (30 May 1983).

8435 (INIS-mf—8642, pp 43) **System for spectrometric activity determination and for analysis of medium and low-level samples.** Kovar, P.; Dryak, P.; Kokta, L.; Novotna, P.; Hrdlickova, L. (Ustav pro Vyzkum, Vyrobu a Vyuziti Radioisotopu, Prague (Czechoslovakia)). May 1983. (In Czech). NTIS (US Sales Only), PC A04/MF A01. (CONF-8305140—Absts.).

From Conference on instrumental activation analysis - IAA 83; Klucenice, Czechoslovakia (30 May 1983).

8436 (INIS-mf—8642, pp 44) **Use of low-background gamma spectrometry in testing source purity.** Stanicek, J. (Komenskeho Univ., Bratislava (Czechoslovakia)). May 1983. (In Slovak). NTIS (US Sales Only), PC A04/MF A01. (CONF-8305140—Absts.).

From Conference on instrumental activation analysis - IAA 83; Klucenice, Czechoslovakia (30 May 1983).

8437 (JAERI-M—82-056) **Programs for the automatic gamma-ray measurement with CANBERRA 8100/QUANTA system.** Yoshida, Hiroshi; Sakai, Eiji; Kubo, Katsumi. (Japan Atomic Energy Research Inst., Tokyo). Jul 1982. 169p. (In Japanese). NTIS (US Sales Only), PC A08/MF A01. Order Number DE83704197.

Some programs have been prepared for the automatic operation of the CANBERRA 8100/QUANTA System for the gamma-ray spectrum measurement. The main parts of these programs are: (1) to collect and record on magnetic disks the data of gamma-ray spectra automatically, while the recorded data are analyzed to estimate the nuclides which generate photopeaks of spectra and to calculate those concentrations; (2) to draw plotted diagrams of pulse height distributions of gamma-ray spectra data and other data by the additional digital plotter; and etc.

8438 (LA-UR—83-3349) **Fieldable computer system for determining gamma-ray pulse-height distributions, flux spectra, and dose rates from Little Boy.** Moss, C.E.; Lucas, M.C.; Tisinger, E.W.; Hamm, M.E. (Los Alamos National Lab., NM (USA); Technical Programming Services, Pleasanton, CA (USA)). 1984. Contract W-7405-ENG-36. 10p. (CONF-840202—5). NTIS, PC A02/MF A01. Order Number DE84003829.

From 17. midyear topical meeting of the Health Physics Society; Pasco, WA, USA (5 Feb 1984).

Our system consists of a LeCroy 3500 data acquisition system with a built-in CAMAC crate and eight bismuth-germanate detectors 7.62 cm in diameter and 7.62 cm long. Gamma-ray pulse-height distributions are acquired simultaneously for up to eight positions. The system was very carefully calibrated and characterized from 0.1 to 8.3 MeV using gamma-ray spectra from a variety of radioactive sources. By fitting the pulse-height distributions from the sources with a function containing 17 parameters, we determined theoretical repsonse functions. We use these response functions to unfold the distributions to obtain flux spectra. A flux-to-dose-rate conversion curve based on the work of Dimbylow and Francis is then used to obtain dose rates. Direct use of measured spectra and flux-to-dose-rate curves to obtain dose rates avoids the errors that can arise from spectrum dependence in simple gamma-ray dosimeter instruments. We present some gamma-ray doses for the Little Boy assembly operated at low power. These results can be used to determine the exposures of the Hiroshima survivors and thus aid in the establishment of radation exposure limits for the nuclear industry.

8439 (LA-UR—83-3384) **Health physics applications of nuclear safeguards radiation monitors.** Fehlau, P.E.; Dvorak, R.F. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 9p. (CONF-840202—1). NTIS, PC A02/MF A01. Order Number DE84003842.

From 17. midyear topical meeting of the Health Physics Society; Pasco, WA, USA (5 Feb 1984).

Nuclear safeguards needs fostered the development of radiation monitors whose sensitivity and microprocessor-controlled logic permit detection of small, transient increases in environmental levels of gamma radiation. While this capability was originally developed to detect the diversion of the special nuclear materials ^{235}U and plutonium, adaptation to health physics monitoring is straigthforward. Applications of the safeguards instruments range from small, handheld instruments used to monitor laundry of salvage-bound materials to more complex systems devoted to monitoring moving vehicles at entry/exit points. In addition to these health physics applications, other new applications for safeguards instruments are being considered.

8440 (LA-UR—83-3398) **Energy response and dose-rate calibration of a Geiger-Mueller gamma-ray detector.** Plassmann, E.A.; Pederson, R.A.; Moss, C.E. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 8p. (CONF-840202—4). NTIS, PC A02/MF A01. Order Number DE84003824.

From 17. midyear topical meeting of the Health Physics Society; Pasco, WA, USA (5 Feb 1984).

To obtain more precise dose-rate measurements, we have taken a commercial gamma-ray dosimeter that uses a Geiger-Mueller (GM) tube as its detector and, by supplying it with an externally regulated high voltage, counted the gamma-ray-induced pulses with suitable scaling and timing circuits. We have now improved the method of calibration by measuring detector response to 13 different sources, each with an independently verified strength, in the energy range from 60 keV to 2.6 MeV. With the use of computer codes, the resulting response curve can be folded into the spectrum of the source to be measured.

8441 (LA-UR—83-3409) **Smart instrumentation development at Los Alamos.** Erkkila, B. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 12p. (CONF-840202—3). NTIS, PC A02/MF A01. Order Number DE84003821.

From 17. midyear topical meeting of the Health Physics Society; Pasco, WA, USA (5 Feb 1984).

For several years Los Alamos has incorporated microprocessors into instruments to expand the capability of portable survey type equipment. Beginning with portable pulse height analyzers, the developments have expanded to small dedicated instruments which handle the measurement and interpretation of various radiation fields. So far, instruments to measure gamma rays, neutrons, and beta particles have been produced. The computer capability built into these instruments provides significant computational power into the instruments. Capability unheard of a few years ago in small portable instruments is routine today. Large computer-based laboratory measurement systems which required much space and electrical power can now be incorporated in a portable hand-held instrument. The microprocessor developments at Los Alamos are now restricted to radiation monitoring equipment but can be expanded to chemical and biological applications as well. Applications for radiation monitoring equipment and others are discussed.

8442 (LA-UR—83-3530) **Gamma-ray dosimetry measurements of the Little Boy replica.** Plassmann, E.A.; Pederson, R.A. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 8p. (CONF-840202—8). NTIS, PC A02/MF A01. Order Number DE84004371.

From 17. midyear topical meeting of the Health Physics Society; Pasco, WA, USA (5 Feb 1984).

We present the current status of our gamma-ray dosimetry results for the Little Boy replica. Both Geiger-Mueller and thermoluminescent detectors were used in the measurements. Future work is needed to test assumptions made in data analysis.

8443 **(LA-UR—83-3593) Neutron dosimetry of the Little Boy device.** Pederson, R.A.; Plassmann, E.A. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 7p. (CONF-840202—9). NTIS, PC A02/MF A01. Order Number DE84004317.

From 17. midyear topical meeting of the Health Physics Society; Pasco, WA, USA (5 Feb 1984).

Neutron dose rates at several angular locations and at distances out to 0.5 mile have been measured during critical operation of the Little Boy replica. We used modified remmetes and thermoluminescent dosimetry techniques for the measurements. The present status of our analysis is presented including estimates of the neutron-dose-relaxation length in air and the variation of the neutron-to-gamma-ray dose ratio with distance from the replica. These results are preliminary and are subject to detector calibration measurements.

8444 **(LAL—83-01) Large radius self supporting cylindral multiwire proportional chambers to be used at the ASTERIX experiment at LEAR.** Ahmad, S.; Bizot, J.C.; Delcourt, B.; Jeanjean, J.; Jeanjean, M.; Nguyen-Ngoc, H.; Wodrich, W.R. (Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire). Jan 1983. 12p. (CONF-830223—14). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750221.

From Wire chamber conference; Vienna, Austria (15 Feb 1983).

Portions are illegible in microfiche products.

We describe the construction and the performance of large cylindrical multiwire proportional chambers (roughly 2 meters in diameter and 1 meter long) with anode read out system. The inner and the outer cathode planes are made of foil and foam sandwiches. At 100% efficiency average anode plateau widths of about 300 volts are obtained.

8445 **(LAL—83-04) Geiger tube planes as a trigger for the nucleon lifetime experiment in the Frejus tunnel (France).** Dudelzak, B.; Eschstruth, P.; Grelaud, B.; Jullian, S.; Lalanne, D.; Laplanche, F.; Longuemare, C.; Paulot, C.; Roy, P.; Szklarz, G. (Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire). Feb 1983. 15p. (CONF-830223—15). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750222.

From Wire chamber conference; Vienna, Austria (15 Feb 1983).

Geiger tubes 6 meters long made of extruded aluminium and assembled in 6m x 6m planes have been developed at Orsay and will be used as a trigger for the nucleon lifetime experiment in the Frejus tunnel (Aachen-Orsay-Palaiseau-Saclay-Wuppertal Collaboration) which will start in the spring of 1983. There will be 185 trigger planes which correspond to about 65000 tubes. The use of aluminium tubes is advantageous because of their low cost mass production, but obtaining a stable Geiger mode operation of aluminium tubes of such dimensions is difficult and requires a preliminary mechanical treatment of the surface. Safety regulations in the tunnel limit the choice of gas. The gas used is a non inflamable mixture of argon, ethyl-alcohol (2%) and freon (0.05%). The two characteristic parts of the Geiger pulse: steep rise in about 50 ns, followed by a long part lasting about 30 to 70 μs are both advantageously used, the first to build a fast trigger, the second as a kind of natural memory. Moreover the relatively high Geiger signal reduces amplification requirements thereby simplifying the electronics.

8446 **(LBL—15960) Standard digital data busing system for use with NIM modules.** Kirsten, F.A. (Lawrence Berkeley Lab., CA (USA)). Oct 1983. Contract AC03-76SF00098. 6p. (CONF-831015—27). NTIS, PC A02/MF A01. Order Number DE84004957.

From Nuclear science symposium; San Francisco, CA, USA (19 Oct 1983).

A NIM Committee working group has recently completed a specification that defines a standard digital bus for use with NIM modules. The standard bus is based on the General Purpose Instrumentation Bus of IEEE Standard 488. It incorporates a subset of the codes and conventions for the GPIB given in IEEE Standard 728. The standard bus definition also includes specifications for additional features and provisions that are special to the NIM application. The most prominent of these is the set of mnemonics defined for information transfer.

8447 **(LYCEN—8290) Detection of charged particles with phoswich counter.** Pastor, C.; Benrachi, F.; Chambon, B.; Drain, D.; Dauchy, A.; Giorni, A.; Morand, C. (Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire). Dec 1982. 11p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750231.

The essential features, construction details and performance of a phoswich detector are described. Results about the Z and mass identification, energy calibration and total energy response for protons, deuterons, tritons and alphas in the energy range from 20 up to 80 MeV are presented.

8448 **(PCCF-T—82-04) Solid track detectors used for the dating by thermoluminescence.** Miallier, D. (Clermont-Ferrand-2 Univ., 63 - Aubiere (France). Lab. de Physique Corpusculaire). Oct 1982. 126p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84750215.

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A new α counting technic is presented in the field of the thermoluminescent dating method. It is based upon α particles registration in plastic detectors LR-115 Kodak in close contact with archeological or geological samples. The control of etching and counting conditions allowed improvement of the usual precision of the detector. The following data are collected: α and β dose rates deposited by uranium and thorium series; an approximative value for the uranium-thorium ratio; spatial distribution of α emittors within samples and the radon escape rate. This method was used simultaneously with the "quartz inclusion technique" to date several samples: volcanic lava flows from the "Chaine des Puys" (Center France); the Butte de Clermont basaltic maar; a neolithic "cardial" pot-sherd and bricks from a minoaan palace (Mallia, Crete).

8449 **(RL—82-113) Microcomputer for a packet switched network.** Seller, P.; Bairstow, R.; Barlow, J.; Waters, M. (Science Research Council, Chilton (UK). Rutherford and Appleton Labs.). Dec 1982. 38p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83704153.

The Bubble Chamber Research Group of the Rutherford and Appleton Laboratory has a large film analysis facility. This comprises 16 digitising tables used for the measurement of bubble chamber film. Each of these tables has an associated microcomputer. These microcomputers are linked by a star structured packet switched local area network (LAN) to a VAX 11/780. The LAN, and in particular a microcomputer of novel architecture designed to act as the central switch of the network, is described.

8450 **Real-time neutron beam monitor.** Becker, J.A. (California Univ., Livermore (USA). Lawrence Livermore National Lab.). *Nuclear Instruments and Methods in Physics Research;* **211**: No. 2/3, 297-300(15 Jun 1983).

An array of multiwire proportional counters has been employed to image, in 'real-time', a collimated neutron beam produced at an electron linac facility. Test results are presented, along with a discussion of the advantages of this technique.

8451 **Proposal for a semiconductor high resolution tracking detector.** Rehak, P. (Brookhaven National Lab., Upton, NY (USA)). *Nuclear Instruments and Methods in Physics Research;* **211**: No. 2/3, 323-329(15 Jun 1983).

A 'new' concept for detection and tracking of charged particles in high energy physics experiments is proposed. It combines a well known high purity semiconductor diode detector (HPSDD)

with a heterojunction structure (HJ) and a negative electron affinity (NEA) surface. The detector should be capable of providing a two dimensional view (few cm^2) of multi-track events with the following properties: a) position resolution down to a few μm (10^8 position elements); b) high density of information (10^2-10^3 dots per mm of minimum ionizing track); c) high rate capabilities (few MHz); d) live operation with options to be triggered and/or the information from the detector can be used as an input for the decision to record an event.

8452 **In-beam gamma-ray studies with tritons.** Becker, J.A.; Carlson, J.B.; Lanier, R.G.; Maier, K.H.; Mann, L.G.; Struble, G.L. (California Univ., Livermore (USA). Lawrence Livermore National Lab.); Nail, T.W.; Sheline, R.K.; Stoeffl, W.; Ussery, L.E. (Florida State Univ., Tallahassee (USA)). *Nuclear Instruments and Methods in Physics Research;* **211**: No. 2/3, 379-385(15 Jun 1983).

The (t, 2n) reaction has been used to study gamma rays from targets of ^{208}Pb and ^{204}Hg as a method of investigating this in-beam reaction. Although the methods and results are similar to those obtained from the (α, 2n) and (p, 2n) reactions, the (t, 2n) reaction is capable of populating with large cross sections nuclei which cannot be strongly populated by other reactions. Both the excitation function and gamma-ray distribution data yield useful information for spin assignments.

8453 **Monte Carlo study of the response of a germanium detector to electrons and positrons.** Noma, H.; Avignone, F.T. III (South Carolina Univ., Columbia (USA). Dept. of Physics and Astronomy); Moltz, D.M.; Toth, K.S. (Oak Ridge National Lab., TN (USA)). *Nuclear Instruments and Methods in Physics Research;* **211**: No. 2/3, 391-402(15 Jun 1983).

A Monte Carlo code has been developed which predicts electron and positron response functions of a planar intrinsic germanium (Ge) detector. The operational flow chart for the main program is fiven and the function of each subroutine is discussed. The characteristics of the response functions are by considering effects due to bremsstrahlung, annihilation radiation and the total electron transit distance. It is found that electron spectra are distorted primarily near the full energy peak by bremsstrahlung while positron spectra are seriously distorted by both annihilation radiation and bremsstrahlung. Total transit distances calculated here are found to be in good agreement with those calculated using the Bethe-Bloch formula. The effects of bremsstrahlung, annihilation radiation and total stopping distance, calculated independently in the complete code, are then used to construct an abbreviated version which reduces the computer time by a factor of 16. Sample computations are presented for a 16 mm diameter by 7 mm thick, planar detector. The calculated response functions reproduce experimental spectra accurately; they are also used to analyze positron spectra and obtain endpoint energies.

8454 **Two-dimensional position-sensitive MWPC for fission fragments.** Plicht, J. van der; Gavron, A. (Los Alamos National Lab., NM (USA)). *Nuclear Instruments and Methods in Physics Research;* **211**: No. 2/3, 403-406(15 Jun 1983).

A low-pressure, multiwire proportional counter, developed for heavy-ion-induced fission fragment detection is described. The active area is 8x10 cm^2. It is position sensitive in two dimension with a resolution of better than 1.5 mm for both x and y. The time resolution is 175 ps. The detector can withstand count rates greater than 100 kHz.

8455 **Digital pulse-pair detecting circuit.** Bell, Z.W.; McConnell, J.W.; Carroll, E.D. (Oak Ridge National Lab., TN (USA)). *Nuclear Instruments and Methods in Physics Research;* **211**: No. 2/3, 551-553(15 Jun 1983).

Letter-to-the-editor.

A completely digital pulse-pair detecting circuit is described. The inspection interval ranges from approximately 100 ns to 1.3 ms in steps of 20 ns. tests of the circuit indicate reliable operation at input rates up to 25 MHz.

8456 (LA-tr—83-23) **Characteristics of the French system for the detection of criticity accidents.** Barbry, F.; Prigent, R. (Los Alamos National Lab., NM (USA)). 1983. Contract W-7405-ENG-36. Translated from international seminar on criticality studies program and needs; Dijon, France, September 19-22, 1983. 23p. NTIS, PC A02/MF A01. Order Number DE84002582.

The first versions of these devices were put in operation in the industry during 1976, i.e., more than 10 years after the very first criticity detection and warning systems in France. Today some 350 probes are installed.

8457 **Fluctuation phenomena in the proportional counter.** Sephton, J.P. Leicester, England; Leicester University (1981). 309p. British Library, Boston Spa, Wetherby, West Yorks. No. D44901/83.

Fluctuations in the number of electron-ion pairs produced in the primary ionization and in the size of the subsequent electron avalanche, can be reduced by improving the efficiency of the ionization mechanisms by the Penning effect. Energy spent exciting metastable states is used to increase the ionization yield by introducing a second gas whose first ionization potential is slightly lower than the first metastable level of the main gas. A proportional counter filled with a range of Penning mixtures has been investigated experimentally. The Penning mixture argon-xenon gives an increased resolution over argon-methane. For fundamental studies of avalanche fluctuations in Penning mixtures, a uniform field chamber has been constructed. Experimental studies of f (the relative variance of the avalanche size) are compared with values predicted by various avalanche models. The results are reasonably close to predictions based on experimental measurements of ionization probability.

8458 **Use of the response function in the analysis of complex neutron spectra.** Kegel, G.H.R.; Ciarcia, C.; Couchell, G.P.; Shao, J. (Univ. of Lowell, MA). pp 897-899 of Nuclear data for science and technology. Boeckhoff, K.H. (ed.). New York, NY; Unipub (1974).

Neutron time-of-flight spectra with overlapping peaks must be unfolded to yield contributions of individual neutron groups. This requires an accurate knowledge of the resolution profile of each group. It is also desirable to know the shape of the spectra of neutrons which were scattered more than once in the scatterer, so that corrections for multiple interactions can be made. These resolution profiles and spectra shapes are not readily available. We have developed a series of measures to account for these effects in our work. We monitor the neutron target thickness during target preparation with a separate time-of-flight spectrometer; we measure detector and accelerator time resolutions for different neutron energies using a thin target and we use computer codes to simulate those factors not amenable to direct measurement.

4402 Radiation Effects On Instrument Components, Instruments, Or Electronic Systems

8459 (INIS-mf—8584, pp 210-211) **Radiation resistance of NaI(Tl) single crystal.** Jursova, L.; Pavlicek, Z. (Tesla, Premysleni (Czechoslovakia). Vyzkumny Ustav Pristroju Jaderne Techniky). [nd]. (In Czech). NTIS (US Sales Only), PC A09/MF A01. (CONF-8105231—).

From Conference on nucleonic instruments and their use in the CSSR; Pribram, Czechoslovakia (18 May 1981).

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4403 Miscellaneous Instruments

REFER ALSO TO CITATION(S) 7234, 7468, 8056, 8065, 8071, 8282, 8669, 9201

8460 (AD-A—131477/2) **Magnetic field gradiometer. Final technical report.** Fraser-Smith, A.C. (Stanford Univ., CA (USA). Dept. of Electrical Engineering). Feb 1983. 97p. NTIS, PC A05/MF A01.

This report has two principal goals. First, to present a general review of magnetic field gradiometers and, second, to provide new data concerning these gradiometers, including new information about their response to magnetic dipole fields. A system of nomenclature is introduced that is consistent with the mathematical concept of gradient and which provides a basis for discussions of the different functions of magnetic field gradiometers and differential magnetometers. The distinction between component gradiometers and total field gradiometers is also stressed.

8461 **(AD-A—131546/4) Nuclear moment alignment, relaxation and detection mechanisms. Final technical report, March 1982-February 1983.** Nicol, A.T.; Lam, L.; Boley, W. (Litton Systems, Inc., Woodland Hills, CA (USA). Guidance and Control Systems Div.). Mar 1983. 95p. NTIS, PC A05/MF A01.

The reported physics research is part of an overall program to develop a nuclear magnetic resonance gyro that makes use of an optically pumped alkali metal vapor both to align the magnetic moments of the noble gas nuclei and to detect the weak magnetic fields that are generated by these precessing nuclear moments. A model for the distribution of polarization of optically pumped rubidium across a sample cell is developed. Results of the computer modeling are presented graphically for various cells as a function of cell size, incident light intensity, wall type and gas fill. A study of the effect of direct nuclear dipole-dipole interaction on surface relaxation of 129Xe is reported. Results indicate that the mechanism for 129Xe nuclear relaxation on surfaces studied is not the direct dipolar interaction and must be attributed to an electron-nucleus interaction. Studies of 129Xe relaxation on several surface types show an order of magnitude more efficient than silicone treated surfaces for relaxing xenon nuclear spins.

8462 **(DOE/ER/10627—T1) Use of nuclear magnetic resonance techniques for the measurement of two-phase phenomena. Final report.** Saxe, R.F. (North Carolina State Univ., Raleigh (USA). Dept. of Nuclear Engineering). Jun 1983. Contract AS05-80ER10627. 24p. NTIS, PC A02/MF A01. Order Number DE84004116.

The work reported was to develop a method using nuclear magnetic resonance techniques by which space-dependent, time-dependent two-phase measurements may be made. In the apparatus used, water was the medium and the nuclei undergoing NMR are those of hydrogen. Results demonstrate that this method is capable of showing the void fraction as a function of distance and time. Although a gradient was only applied in one direction, it is possible to apply a gradient in each of the other two directions. It is concluded that the results obtained show the method to be capable of delineating void distributions in two-phase phenomena with a temporal and spatial resolution which makes it a useful investigative tool. Further, although the studies reported used water as the investigated medium, it would be equally valid to use freon since fluorine has NMR properties very similar to hydrogen.

8463 **(FRNC-TH—1154) Study and construction of a data acquisition and processing system adapted to renewable energies.** Rouan, P. (Toulouse-3 Univ., 31 (France)). 1981. 146p. (In French). NTIS (US Sales Only), PC A07/MF A01. Order Number DE84750257.

AIM 65.

The specific problems raised by the development of renewable energies has led to designing and building a particular type of measuring centre. In order to do so, the choices made involved the development of different measurement modules which will be used by the laboratory centre or by the independent small centres. They each include sixteen or thirty two multiplex channels. They are controlled by a microcomputer whose performance and peripheral equipments depend on the application in view: process measuring or testing. The detailed description and the performance of modules built are presented: the aim of the system, the module for interfacing to an AIM 65 microcomputer, the temperature measuring chart, the power and energy measuring chart and the high voltage measuring chart. Other achievements are presented in an appendix. Three applications have been selected for illustrating the application possibilities of the data acquisition and processing system: temperature determination, finding the optimum operating point of a photovoltaic generator and control of a solar pump.

8464 (INIS-mf—8584, pp 198-209) **Add-on for gamma chromatography NX 1701.** Dvorak, V.; Hajek, J.; Gregor, J. (Tesla, Premysleni (Czechoslovakia). Vyzkumny Ustav Pristroju Jaderne Techniky); Kozak, I. (Karlova Univ., Prague (Czechoslovakia). Lekarska Fakulta). [nd]. (In Czech). NTIS (US Sales Only), PC A09/MF A01. (CONF-8105231—).

From Conference on nucleonic instruments and their use in the CSSR; Pribram, Czechoslovakia (18 May 1981).

An auxiliary device for the NRB 901 radiochromatogram evaluating instrument used for the evaluation of flat or one-dimensional gamma-labelled radiochromatograms is described. It consists of a bracket into which a detection unit provided with a collimator and an aperture is inserted. The instrument specifications and the results of comparative measurements are given.

8465 **(INIS-mf—8655) Ultra-sensitive instrument for collision activated dissociation mass spectrometry with high mass resolution.** Louter, G.J. (Technische Hogeschool Delft (Netherlands)). 23 Feb 1982. 118p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE83704764.

During the last decade Collision Activated Dissociation Mass Spectrometry (CAD-MS) has developed into an important and sometimes unique technique for the structure elucidation of ions. An extensive description of the double stage MS is given, which has been especially devloped for CAD-MS. A high mass resolution and a very high sensitivity are obtained by application of special techniques like post-acceleration of fragment ions, quadrupole (Q-pole) lenses and an electro-optical, simultaneous ion detection system. The operation of the rather complex ion-optics is demonstrated by application of a computer simulation of the tandem MS. Special attention is given to the action of the four Q-pole lenses and the second sector magnet upon curvature and position of the mass focal plane. Two mass calibration methods are described for the fragment spectra. The so-called polynomial-method applies a fifth-order polynomial approximation of the functional relation between position on the detector and corresponding relative momentum of fragment ions. The second method uses the matrix model of the instrument. The detector consists of two channelplates (CEMA), a fibre optics slab, coated with a phosphor layer, a camera objective and a 1024-channels photodiode-array. A biochemical and an organic-chemical application of the instrument are given. As bio-chemical application the peak m/z 59 in the pyrolysis mass spectrum of complete mycobacteria is identified. As an example of organic-chemical application the fragmentation process of 2,3-butadienoic acid has been investigated.

8466 **(LBL—15942) Multichannel interval timer.** Turko, B.T. (Lawrence Berkeley Lab., CA (USA)). Oct 1983. Contract AC03-76SF00098. 8p. (CONF-831015—28). NTIS, PC A02/MF A01. Order Number DE84004635.

From Nuclear science symposium; San Francisco, CA, USA (19 Oct 1983).

A CAMAC based modular multichannel interval timer is described. The timer comprises twelve high resolution time digitizers with a common start enabling twelve independent stop inputs. Ten time ranges from 2.5 μs to 1.3 μs can be preset. Time can be read out in twelve 24-bit words either via CAMAC Crate Controller or an external FIFO register. LSB time calibration is 78.125 ps. An additional word reads out the operational status of twelve stop channels. The system consists of two modules. The analog module contains a reference clock and 13 analog time stretchers. The digital module contains counters, logic and interface circuits. The timer has an excellent differential linearity, thermal stability and crosstalk free performance.

8467 **(NP—4770031) Research on microbiological systems with a twin calorimeter.** Bolouri, H. (Freie Univ. Berlin (Germany, F.R.). Fachbereich Biologie). 26 Jun 1981. 77p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84770031.

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The dynamical behaviour of the break-down of different excrements was investigated. The energy limitation of cattle manure is especially apparent. No further rise in temperature was observed after the self-heating process was over. The break-down of most

types of manure was completed in 2 to 4 days with a maximum temperature of 70 - 75°C. The specific heat production was 500 kJ per kg, and the rate between 2,15 - 7,79 W per kg of fresh material. Cattle dung, however, reached a maximum temperature of only 45°C after 5,5 days. The specific heat production was 225 kJ per kg and the rate was 2,01 W per kg of fresh material. The combustion of different types of dung yielded specific heat contents of 11,9 to 17,5 kJ per g and ash contents of 11,5 to 20,8%. The specific heat contents for ash-free combustion equaled 15,0 - 20,0 kJ per g. The experiments showed that only about 3% of the energy content of manure were made available during biological break-down.

8468 **(PB—83-247452) Dynamic dilution system for auditing ambient sulfur dioxide analyzers. Project summary report.** Barnard, W.F.; Brande, R.E. (Environmental Protection Agency, Research Triangle Park, NC (USA). Environmental Monitoring and Systems Lab.). Aug 1983. 21p. (EPA—600/D-83-115). NTIS, PC A02/MF A01.

This paper discusses the development, evaluation, and field performance of a device designed to provide accurate sulfur dioxide concentration standards suitable for auditing the accuracy of continuous, ambient SO_2 monitors. This compact, lightweight, device has been subjected to extensive testing and found to be a reliable and accurate SO_2 audit system. A discussion of the evaluation and acceptance testing as well as the results from two years of field audits is presented.

8469 **(UCID—19946) S-20 photocathode research activity. Part I.** Gex, F.; Huen, T.; Kalibjian, R. (Lawrence Livermore National Lab., CA (USA); Observatoire de Paris, 75 (France)). 22 Nov 1983. Contract W-7405-ENG-48. 40p. NTIS, PC A03/MF A01. Order Number DE84004703.

The goal of this activity has been to develop and implement S-20 photocathode processing techniques at Lawrence Livermore National Laboratory (LLNL) in order to study the physical properties of the photocathode films. The present work is the initial phase of a planned activity in understanding cathode fabrication techniques and the optical/electrical characterization of these films.

8470 **Air-bridge microbolometer for far-infrared detection.** Neikirk, D.P.; Rutledge, D.B. (Division of Engineering and Applied Science, California Institute of Technology, Pasadena, California 91125). *Applied Physics Letters;* **44**: No. 2, 153-155(15 Jan 1984). Contract AM03-76SF00010.

A new microbolometer for far-infrared detection has been fabricated that allows an increase in sensitivity of a factor of 4 over the best previously reported bolometer. By suspending the detector in the air above its substrate a reduction in the thermal conductance out of the device by a factor of 5 has been achieved. At a modulation frequency of 100 kHz this microbolometer has an electrical noise equivalent power of 2.8×10^{-11} W(Hz)$^{-1}$/sup //^{2}. A thermal model is also presented that accurately fits the response of the detector.

8471 **Versatile double-crystal topography camera.** Kuo, C.L.; Emamian, M.; Bilello, J.C. (Department of Materials Science and Engineering, State University of New York at Stony Brook, Stony Brook, New York 11794). *Review of Scientific Instruments;* **55**: No. 1, 107-109(Jan 1984). Contract AC02-80ER10740.

A versatile double-crystal topography camera is described which has provisions for both image detection and precision rocking curve analysis for a wide variety of single-crystal samples. The camera has a variable base separating the two crystals and this base is rotatable for working with a range of diffraction vectors. The accuracy of the second crystal goniometer stage is of the order of 0.2 arc s. An example of typical data taken with this camera is displayed.

8472 **Photoacoustic study of diffuse light scattering from a diffraction grating.** Inagaki, T.; Motosuga, M.; Yamamori, K.; Arakawa, E.T. (Osaka Kyoiku University, Physics Department, Tennoji, Osaka 543, Japan). *Applied Optics;* **22**: No. 19, 3009-3012(1 Oct 1983). Contract W-7405-ENG-26.

A photoacoustic technique was used to evaluate total diffuse light scatterig from a diffraction grating as functions of incidence angle and polarization of 632.8-nm photons. Diffuse light scattering for a 520-line/mm silver-coated replica grating was found to decrease with increasing angle of incidence and to exhibit no strong dependence on polarization of the incident photons, except in the angular regions where surface plasmons were excited.

8473 **Spin sample reader.** Litt, B. US Patent Application 6-504,117. 14 Jun 1983. 12p.

A spin sample reader for holding and reproducibly moving a sample to be read by an analyzer comprises a fixed support, a first arm pivotally mounted to the fixed support and a second arm pivotally mounted to the first arm. The first and second arms are also engaged for slidable movement with radial scales between the support and the first arm and between the first and second arms, and a linear scale also provided between the first and second arms. A sample support disc is rotatably mounted to an end of the window of the analyzer. Equipment is provided for incrementally rotating the disc by preselected amounts. By reading the scales and rotating the disc at each scale reading, an entire sample can be symmetrically scanned.

8474 **Pore pressures in marine sediments--1981 test of the Geotechnically Instrumented Seafloor Probe (GISP).** Prindle, R.W.; Lopez, A.A. (Sandia National Laboratories). *Offshore Technology Conference;* **1**: 173-180(May 1983). (CONF-830514—).

From Offshore technology conference; Houston, TX, USA (2 May 1983).

The Geotechnically Instrumented Seafloor Probe (GISP) can make long-term, in-situ measurements of pore water pressure in marine sediments in remote, undeveloped areas. The seafloor package is completely self-contained and includes data processing electronics, solid-state memory, acoustic telemetry, batteries, and pressure transducers. Acoustic telemetry provides the communication link with a surface command and recording system. Two GISP units operated successfully for five months in a 1981 field test on the Mississippi Delta. Data obtained during this test, when combined with the results of SEASWAB I, indicate that from the mudline to a depth of 6 meters, excess pore pressure is near zero. From 6 to 15 meters (the maximum depth studied), excess pore pressure increases at about the same rate as total stress.

4404 Well Logging Instrumentation

REFER ALSO TO CITATION(S) 7191, 8225, 8651

8475 **(INIS-mf—8592) Lecture notes on: Neutron- and γ-gauges, their principle, theory, use and calibration.** Oelgaard, P.L. (Danmarks Tekniske Hoejskole, Lyngby. Afdelingen for Elektrofysik). Aug 1981. 159p. NTIS (US Sales Only), PC A08/MF A01. Order Number DE83703954.

The lecture notes are divided into five parts. In part I neutron sources based on (α,n) and (γ,n) reaction as well as on spontaneous fission and the use of accelerators are discussed. The source spectra are considered and the slowing-down of fast source neutrons is calculated. Finally, the basic concepts of neutron transport such as nuclear cross sections, mean free path, reaction rate and neutron flux are discussed. In part II a formula for the neutron current density is derived and from this the two-group and three-group diffusion equations for fast and thermal neutrons are established. For a fast neutron point source in an infinite medium, the flux-distribution around the source is calculated by use of two- and three-group theory and by Fermi-age theory. Neutron detectors are also discussed. In part III (n,n)-gauges, containing a fast neutron source and a thermal or near-thermal neutron detector, are considered together with their practical applications, in particular measurements of water content. The calibration of such gauges is described and the factors influencing the measurements such as dry bulk density and chemical composition are discussed. In part IV the interactions of γ-quanta with matter are discussed and formulas for reaction cross sections, absorption coefficients, build-up factors and γ-flux are presented. Simplified models for (γ-γ)-gauges, containing a γ-source and a γ-detector, are derived both for a backscatter and a

transmission gauge. Different types of γ-detectors are discussed. In part V (n-γ)-gauges based on both capture-γ analysis and activation-γ analysis are considered. In both cases the experimental set-up is discussed, simplified models derived and practical applications described. Finally, a comparison between the two methods is made.

45 EXPLOSIONS AND EXPLOSIVES

4501 Chemical

REFER ALSO TO CITATION(S) 8262

8476 (LA-UR—83-2645) Fundamental research on explosives. Davis, W.C.; Rivera, T. (Los Alamos National Lab., NM (USA)). 1983. Contract W-7405-ENG-36. 6p. (CONF-8310148—10). NTIS, PC A02/MF A01. Order Number DE84001201.

From Los Alamos/CEA high explosives and detonation physics conference; Paris, France (3 Oct 1983).

The nitric oxide molecule is being studied in order to understand the energetics and chemistry of initiation and detonation in liquid NO at the molecular level. An overview is presented of the work being done. (DLC)

8477 (MLM—3111(OP)) Global decomposition kinetics and critical explosion temperatures of 2-(5-cyanotetrazolato) pentaammine cobalt (III) perchlorate. Pickard, J.M. (Monsanto Research Corp., Miamisburg, OH (USA). Mound). 1983. Contract AC04-76DP00053. 12p. (CONF-8310159—7). NTIS, PC A02/MF A01. Order Number DE84002828.

From Joint symposium on compatibility of plastics/materials with explosives, propellents and pyrotechnics; Lake Ozark, MO, USA (31 Oct 1983).

Kinetics of decomposition of 2-(5-Cyanotetrazolato) Pentaammine Cobalt (III) Perchlorate, CP, at constant pressure and constant volume were determined with isothermal and dynamic differential scanning calorimetry (DSC). The critical explosion temperature (T/sub c/ = 508K) for cylindrical CP pellets with radii of 0.238 cm was determined with accelerating rate calorimetry (ARC) operated in the isothermal mode. DSC data in the early stages of reaction at constant pressure were fitted to an autocatalytic rate law based on a second-order time dependence to obtain: $\log(k/s^{-1}) = (12.38 \pm 0.77) - (155 \pm 8)/\theta$ where theta = 2.303RT kJ/mol. Analysis of the ignition region at constant volume resulted in: $\log(k/\text{sub i}/s^{-1}) = (22.3 \pm 6.3) - (279 \pm 27)/\theta$. Approximation of the global decomposition mechanism as a two-stage process in which all exoergicity is associated with ignition was found to yield a predicted critical temperature in good agreement with experiment.

8478 (MLM—3113-OP) Determination of trace amounts of cobalt (II) in CP. Kapsch, D.M.; Frye, J.O.; Loyola, V.M.; Womelsduff, J.E. (Monsanto Research Corp., Miamisburg, OH (USA). Mound; Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00053. 9p. (CONF-8310111—8). NTIS, PC A02/MF A01. Order Number DE84002833.

From 11. DOE annual compatibility meeting; Livermore, CA, USA (18 Oct 1983).

CP, 2-(5-cyanotetrazolato)pentaamminecobalt(III) perchlorate, a deflagration-to-detonation explosive, is an inner-sphere complex of Cobalt(III). A method has been developed to quantitate the amount of Cobalt(II) present from synthesis and to measure Cobalt(II) contributions from degradation of aged CP. This method utilizing ion exchange separation and flameless atomic absorption was studied to determine precision and accuracy.

8479 (MLM—3114(OP)) Isotachophoresis: a versatile technique for the determination of ionic species. McCarthy, J.P.; Kapsch, D.M.; Kinard, C. (Monsanto Research Corp., Miamisburg, OH (USA). Mound). 1983. Contract AC04-76DP00053. 10p. (CONF-8310111—10). NTIS, PC A02/MF A01. Order Number DE84002841.

From 11. DOE annual compatibility meeting; Livermore, CA, USA (18 Oct 1983).

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Isotachophoresis (ITP), a method for the electrophoretic separation and quantification of ionic species is currently available at Mound. The technique is applicable for the analysis of virtually any system of charged species. The theory and instrumentation required for this technique are discussed. The application currently being investigated at Mound is the determination of the amide derivative present as an ionic impurity in the explosive 2(5-cyanotetrazolato)pentaamine Co (III) perchlorate. Results indicate 2 to 10% amide content in CP dependent upon the lot analyzed. This analysis is discussed along with other ITP applications.

8480 (MLM—3117-OP) Potassium perchlorate reaction with pyrotechnic fuels. Wang, P.S.; Moddeman, W.E.; Bowling, W.C. (Monsanto Research Corp., Miamisburg, OH (USA). Mound). 1983. Contract AC04-76DP00053. 18p. (CONF-8310111—9). NTIS, PC A02/MF A01. Order Number DE84002840.

From 11. DOE annual compatibility meeting; Livermore, CA, USA (18 Oct 1983).

Surface sensitive x-ray photoelectron spectroscopy (XPS) and x-ray induced Auger electron spectroscopy (XAES) were used to analyze surface changes in Fe/$KC10_4$, TiH/sub 0.65//$KC10_4$ and Al foils in $KC10_4$ during accelerated aging at 60 and 120°C. The result shows a 0.02% Cl^- formation per day in Fe/$KC10_4$ and TiH/sub 0.65//$KC10_4$ powders aged at 120°C for ≦ 145 days. No $KC10_4$ decomposition was observed under the similar aging conditions in $KC10_4$ samples without pyrotechnic fuels. Titanium oxide to $KC10_4$ signal ratio in a pressed disk of TiH/sub 0.65//$KC10_4$ was found to be lower than that of the powdered samples. Carbon impurities were noted in all powders, especially strong in metal (or subhydride) containing specimens; carbon impurities were slightly removed from the subhydride during aging.

8481 (MLM—3119(OP)) Compatibility of PETN with lead azide. Hurd, R.; Fronabarger, J.W.; Johnson, R.; Fleming, W. (Monsanto Research Corp., Miamisburg, OH (USA). Mound; Unidynamics/Phoenix, Inc., AZ (USA)). 1983. Contract AC04-76DP00053. 26p. (CONF-8310159—6). NTIS, PC A03/MF A01. Order Number DE84002827.

From Joint symposium on compatibility of plastics/materials with explosives, propellents and pyrotechnics; Lake Ozark, MO, USA (31 Oct 1983).

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The compatibility of PETN with lead azide at elevated temperatures has been investigated. Ramped and isothermal DSC methods were used to obtain energies of activation at temperatures above the melting point of PETN. Mixtures were found to show exothermic activity at lower temperatures than pure PETN. High Pressure Liquid Chromatography was used to follow the decomposition of PETN and PETN/lead azide mixtures at temperatures below the melting point. Reaction below 120°C appeared minimal, while at higher temperatures, both PETN and PETN/lead azide mixtures showed degradation. A PETN/lead azide sample exploded at or near the melting point of PETN.

8482 (UCRL—88976) Improvements in thin-pulse shock initiation threshold measurements. Bloom, G.; Chau, H.; Glaser, R.; Honodel, C.; Lee, R.S.; Weingart, R.C. (Lawrence Livermore National Lab., CA (USA); Kansas State Univ., Manhattan (USA). Dept. of Physics). 14 Jul 1983. Contract W-7405-ENG-48. 5p. (CONF-830719—54). NTIS, PC A02/MF A01. Order Number DE84001426.

From American Physical Society meeting on shock waves in condensed media; Santa Fe, NM, USA (18 Jul 1983).

At LLNL we have been evaluating shock-initiation threshholds for various explosives for a number of years, using thin flyer plates accelerated by an electric gun as the shock stimulus (1 to 3). It is advantageous in time and expense to minimize the number of test specimens required for a threshold determination. We have recently improved our velocity calibrated and our experimental protocol in selecting firing voltages so that we can usually obtain a good estimate of the threshold using only 8 to 10 samples.

8483 **(UCRL—89664) Equations of state of PBX-9404, LX-07, and RX-26-AF detonation products at pressures above detonation pressure.** Green, L.; Lee, E.; Mitchell, A.; Tipton, R.; Van Thiel, M.; Finger, M. (Lawrence Livermore National Lab., CA (USA)). 14 Oct 1983. Contract W-7405-ENG-48. 13p. (CONF-8310173—2). NTIS, PC A02/MF A01. Order Number DE84002465.

From Nuclear explosives design conference; Los Alamos, NM, USA (15 Oct 1983).

Overdriven detonation experiments on LX-07-2, PBX-9404, and RX-26-AF show the need to modify the currently used JWL EOS' when pressures above C-J are encountered in the detonation products. It appears that the overdriven detonation results on PBX-9404 can be used to approximate the overdriven state in other high HMX PBX's. Additional experiments may show that the Chapman/Jouguet theory itself must be modified. 15 figures.

8484 **(UCRL—89884) Non-equilibrium effects seen in molecular dynamics calculations of shock waves in solids.** Walker, F.E.; Karo, A.M.; Hardy, J.R. (Lawrence Livermore National Lab., CA (USA); Nebraska Univ., Lincoln (USA). Behlen Lab. of Physics). 28 Sep 1983. Contract W-7405-ENG-48. 12p. (CONF-8308129—1). NTIS, PC A02/MF A01. Order Number DE84001241.

From NATO Advanced Study Institute conference on non-equilibrium cooperative phenomena in physics and related fields; Madrid, Spain (1 Aug 1983).

The present work clearly demonstrates that strong shock fronts, apparently because of their extreme sharpness on an atomic scale, can impart to internal molecular motion startlingly large amounts of energy (~ eV's per bond) over dramatically short times (~ 10^{-12} - 10^{-13} sec). As a consequence, for a considerable period of time during and after shock transit, the internal energy of the molecule is one to two orders of magnitude larger than the thermal energy remaining in the host lattice after the shock has passed. Although the present studies concern only diatomic systems, it would appear that the uptake of energy per bond would remain largely unchanged for polyatomic systems. Thus, large molecules should readily and rapidly be excited to the point of dissociation by shock loading. For such dissociation to occur it is obviously necessary for such molecules to be free to escape from their host environment. If this is not the case, the excess energy in the molecule will dissipate and may in fact do so rapidly. Escape mechanisms are obviously provided by defects such as surfaces, interfaces, and microscopic voids. Defects such as these could then serve as sources of free radicals which, should the shock-loaded material be an explosive, provide a mechanism for initiating detonation.

8485 **Shock initiation of detonation in a dilute explosive.** Fickett, W. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physics of Fluids;* 27: No. 1, 94-105(Jan 1984).

The plane-shock initiation of detonation in the limiting case of small heat release is studied by a linear perturbation analysis, with a small parameter which is roughly the ratio of chemical to mechanical energy. The solution consists of three waves traveling at different velocities. One of these is a steady wave and two are transients. The wave shapes are simply related to the composition dependence of the reaction rate.

4502 Nuclear

REFER ALSO TO CITATION(S) 8442, 8443, 8694, 8695

8486 **(AD-A—131147/1) Firestorms. Technical report.** Carrier, G.F.; Fendell, F.E.; Feldman, P.S. (TRW, Inc., Redondo Beach, CA (USA)). 15 Apr 1982. 84p. (TRW—38163-6001-UT-00). NTIS, PC A05/MF A01.

Firestorms have arisen from the merger of fires from multiple simultaneous ignitions in a heavily fuel-laden (urban) environment. Within an hour surface-level radial inflow from all directions sustains a large-diameter convective column; typically, the firestorm reaches peak intensity in a couple of hours, with inflow speeds inferred to attain 25-50 m/s and with the plume reaching 10 km (e.g., Hamburg, Dresden, Hiroshima). Winds associated with the nonpropagating holocaust relax to ambient in six-to-nine hours, with often 12 km to the 2nd power reduced to ashes. Here the firestorm is interpreted to be a mesocyclone (rotating severe local storm), with exothermicity from combustion (rather than condensation of water vapor) supporting convectively induced advection. The rapid swirling of the surrounding air results in reduction of entrainment into the plume, such that the mass flux ascending in the buoyant plume is furnished entirely by a near-ground layer with large radial inflow. Integral treatment of a convective column over a maintained heat source in the absence of a cross-wind is generalized to include (1) reduction of entrainment with swirling; (2) stratification of the ambient that varies with altitude; and (3) time evolution based on spin-up under conservation of angular momentum, incorporating large radial pressure gradient. Only exceedingly large heat release rate sustained over a concentrated area, in the presence of a very nearly mechanically unstable atmospheric stratification, is consistent with onset of vigorous swirling on the scale of two hours.

8487 **(AD-A—131174/5) Asymmetric collapse of LOS pipe-LS-4. Final report, 1 February 1980-1 December 1980.** Mumma, D.; Thomsen, J.; Funston, R.; Moore, E.T. Jr. (Physics International Co., San Leandro, CA (USA)). 1 Mar 1982. 76p. (PIFR—1403). NTIS, PC A05/MF A01.

This report summarizes the results of a single laboratory experiment (LS-4) that was performed to further evaluate the feasibility of using asymmetries to suppress jetting in line-of-sight (LOS) pipes collapsed by the ground shock from an underground nuclear test. Underground conditions were simulated by using a sphere of high explosive to collapse twenty-six small-scale models embedded in saturated sand. Thin-walled, straight, stainless steel tubes were used to model LOS pipes. Models with no further alterations were called standard models. Other models contained some form of asymmetry added to the tube to alter the pipe collapse and jet formation process or to attenuate the jet after it is formed. The results of the experiment show that high-energy jetting of standard models always occurs, is enhanced by increasing the areal density of the pipe wall, and is unaffected by the presence of air in the pipe. Jet energy decreases with the pipe standoff relative to the surface of the high explosive sphere. The use of helical or ring asymmetries was effective in attenuating the jet in all cases where the asymmetry was loosely attached to the inner wall of the Pipe, even when it was positioned beyond the jet forming region of the pipe. Very little jet attenuation was observed when a ring or helical asymmetry was located entirely within an expansion chamber.

8488 **(AD-A—131175/2) Development and exploration of the core-corona model of imploding plasma loads. Final report, 5 February 1979-5 March 1980.** Guillory, J.; Terry, R. (JAYCOR, Alexandria, VA (USA)). 1 Jul 1980. 126p. NTIS, PC A07/MF A01.

The conclusions from the quantitative exploration and generalization of the core-corona model of imploding plasma load dynamics performed over the past 12 months is presented. Several modifications to the original core-corona model were examined as a means to a more physical treatment of the energy transfer between the two regions. The core-corona model arises from four physical considerations, all interrelated. The interrelations among these four assumptions represent time-dependent tests of the model's viability. The model has shown some ability to predict the collapse radii and temperatures with an order-of-magnitude accuracy. With the inclusion of the improved opacity model, very appropriate radiation pulsewidths and amplitudes are also produced, first by the zero-D model and code and now by the 1-D version. The small, fast computer program also makes predictions concerning the time-dependent current partition between core and corona.

8489 **(AD-A—131177/8) Late time containment research. Technical report.** Duff, R.E.; Lie, K.; Barthel, J.R.; Rimer, N.; Proffer, W.J. (S-Cubed, La Jolla, CA (USA)). 1 Jun 1982. 74p. NTIS, PC A04/MF A01.

This summary of Late-Time Containment Research describes the various tasks undertaken during 1981. Cavity conditions were estimated for Red Hot as a function of time, and consideration of connecting tunnel conditions suggested that venting from the cavity

was energetically rather minor. Diablo Hawk diagnostic data permitted the identification of the second LOS flow pulse as steam at a temperature near 3500 deg K. The LOS flow in Miners Iron was found to have a pressure three times higher than on Diablo Hawk. LOS flow studies suggested that aerodynamic forces turn the helical insert into the flow and thereby intercept penetrating flow components. Particle velocity records from grout spheres tests were analyzed to show that the conventional material model for 2C4 grout is unacceptable. Probably strain rate effects, material damage and a relaxation time will be required to give agreement between calculations and the measurements. An algorithm was developed for use in the LANL KRAK code to improve calculations of crack propagation from a cylindrical borehole. This specified how pressure in the borehole should be treated. Several other tasks are discussed briefly.

8490 **(AD-A—131178/6) Simple k-energy radiative scaling law for imploding wire arrays and gas puffs. Technical report.** Workman, J.B.; Prettie, C.W. (Berkeley Research Associates, Inc., CA (USA)). 1 Mar 1982. 20p. NTIS, PC A02/MF A01.

A simple static-K-energy radiation power scaling expression has been derived for element with Z < or = 40. Bound-Bound, Free-Bound, and Free-Free transitions have been included and accounted for in the expression. The results are shown to be in reasonable agreement with a wide range of experimental values.

8491 **(AD-A—131179/4) Early time Starfish calculations. Final report, 30 April 1979-15 June 1980.** Fajen, F.E.; Kilb, R.W. (Mission Research Corp., Santa Barbara, CA (USA)). 1 Feb 1982. 80p. (MRC-R—572). NTIS, PC A05/MF A01.

In this report, we present results from recent CMHD (Collisionless Magnetohydrodynamics) code calculations of the early time (0 to 1 sec.) evolution of the STARFISH event. The emphasis of this report is on the velocity spectrum of the energy going to the conjugate patches. We present a parameter study, utilizing results from eight simplified, CMHD-like calculations, which demonstrates the dominant role played by ionizing collisions during the blast wave expansion.

8492 **(AD-A—131266/9) Forbidden line radiation cooling of high altitude plasmas. Topical report, 1 February 1981-1 February 1982.** White, W.W. (Mission Research Corp., Santa Barbara, CA (USA)). 19 Feb 1982. 108p. (MRC-R—687). NTIS, PC A06/MF A01.

Time dependent rate equations describing electron impact excitation (and Deexcitation) of and forbidden line radiation from ionospheric constituents have been integrated to obtain excited state population densities, radiation rates, ion and electron temperatures, and energy partitions as a function of time. Radiations from low-lying metastable states of oxygen and nitrogen ions, oxygen and nitrogen atoms, and molecular oxygen excited by electrons in the one eV energy range have been computed for plasma compositions characteristics of selected high altitude nuclear explosions.

8493 **(AD-A—131287/5) Single event upset phenomena from high energy neutrons. Topical report, 1 January-1 December 1981.** Pease, R.L.; Raymond, J.P. (Mission Research Corp., Albuquerque, NM (USA)). 1 Dec 1981. 63p. NTIS, PC A04/MF A01.

The susceptibility of circumvented and uncircumvented endoatmospheric and exoatmospheric systems to neutron induced SEU(Single Event Upsets) was considered in very general terms of nuclear weapon threat and system configuration. For both exiatmospheric and endoatmospheric uncircumvented systems it appears that transient upset effects will be dominated by effects of the prompt ionization pulse. In the worst case neutron-induced SEUs are comparable to the upset levels of the prompt ionization pulse. For current microelectronic components the neutron-induced SEUs do not need to be explicitly considered for uncircumvented systems. The relative susceptibilities should be reviewed with the evolution of microcircuit technology, particularly for possible preferential sensitivity to the localized ionization of a neutron-induced reaction compared to bulk ionization sensitivity. For circumvented systems there is a clearly a potential consideration for exoatmospheric systems and a possible consideration for endoatmospheric systems. Given the threat, microcircuit susceptibility and system performance parameters the calculation of potential concern for a circumvented exoatmospheric system is relatively straightforward. The high atmospheric concern is comparable to the exoatmospheric case. In some cases the relative neutron transport can be slightly enhanced over the prompt gamma pulse transport. The total prompt ionization pulse is also reduced by the increased attenuation of the low energy photons.

8494 **(AD-A—131489/7) Simulation of a nuclear blast wave with a gaseous detonation tube. Technical report.** Kuhl, A.L. (R and D Associates, Santa Monica, CA (USA)). 1 Mar 1983. 34p. (RDA-TR—125004-003). NTIS, PC A03/MF A01.

There is an ongoing interest in simulating nonideal blast environments for nuclear effects research. In particular, one would like to be able to impose peaked blast waves on real ground surfaces and experimentally measure the ensuing dusty airblast environment. Proposed here is a gaseous detonation tube blast simulator. A disposable (or reusable) shock tube would be constructed on a in-situ ground surface of interest. The tube would be sealed and filled with a detonatable gas mixture. When a planar detonation wave is initiated at one end of the tube, it induces a peaked blast wave which expands self-similarly with time--the longer the detonation run distance, the longer the blast wave duration. Similarity analysis of such a wave (which consists of a constant-velocity Chapman-Jouguet detonation followed by an adiabatic rarefaction wave expressed in terms of a Riemann characteristic) results in a closed-form analytic solution for the flow field time history. It is shown that the static and dynamic pressure waveforms associated with this detonation give a high fidelity simulation of a nuclear surface burst.

8495 **(AD-A—131581/1) Asymmetric collapse of LOS (line-of-sight) pipe -- LS-5. Final report, 1 March 1981-1 March 1982.** Mumma, D.; Thomsen, J.; Funston, R.; Moore, E.T. Jr. (Physics International Co., San Leandro, CA (USA)). 1 Mar 1982. 64p. (PIFR—1517). NTIS, PC A04/MF A01.

This report describes results of a laboratory experiment, designated LS-5, performed to further evaluate the feasibility of using asymmetries to suppress jetting in line-of-sight (LOS) pipes collapsed by the ground shock from an underground nuclear test. Underground conditions were simulated using a sphere of high explosive to collapse small-scale LOS models embedded in saturated sand. Three tapered models were evaluated to determine the sensitivity of jet flow to the degree of taper. Several asymmetries were tested, including a model of the LOS pipe planned for HURON LANDING. Straight LOS pipe models were also tested with various internal helix and ring asymmetries to provide insight into the mechanisms that make these particular designs so effective in attenuating the penetrating jet material. Aluminum witness plates at the end of the tapered LOS pipe models showed ring-like penetration craters, increasing in diameter with increasing pipe taper. The volume of the target craters was almost constant, even when the taper angle was increased by a factor of four, and this volume was within the spread of volumes measured on witness plates from straight pipe models. Addition of a helix, including that of the HURON LANDING configuration, reduced crater damage; however, the benefit was not as dramatic as that observed for straight pipes, and it decreased as the taper angle increased. Crater damage, ring-like for tapered models without helical asymmetries, was more axial when helices were used.

8496 **(AD-A—131625/6) Improving US theater nuclear doctrine. a critical analysis.** Sollinger, J.M. (National Defense Univ., Washington, DC (USA). Research Directorate). 1983. 77p. NTIS, PC A05/MF A01.

This monograph argues that the doctrine, equipment, and training of US forces do not meet the demands of fighting a theater nuclear war. Current doctrine rests upon questionable assumptions, lacks the flexibility required to fight a tactical nuclear battle, and limits itself by concentrating on defense. Recommended improvements include increased flexibility and decentralized execution, em-

phasizing maneuver and dispersion. Service doctrinal writings should focus on enemy forces rather than terrain. Because the nuclear battlefield promises chaos and confusion, US forces need redundant command and control. The equipment of US forces also needs improving, The services must field equipment capable of withstanding the effects of nuclear weapons. In most cases this requirement means making existing procedures work and the hardening of equipment. Some new items of equipment, such as monitoring devices, are needed. Training requires improvement at both the individual and unit levels. Individual enlisted training tends to concentrate specialized knowledge at too high a level. With substantial casualties expected in a nuclear battle, US forces cannot afford to confine specialized knowledge to a few individuals.

8497 **(CONF-840133—3) Aerothermoballistics of pyrophoric metal shrapnel in high speed, high Weber number flows.** Connell, L.W. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 10p. NTIS, PC A02/MF A01. Order Number DE84003761.

From 11. aerospace sciences meeting; Reno, NV, USA (9 Jan 1984).

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A numerical simulation is presented on the aerothermoballistic behavior of pyrophoric metal shrapnel ejected at supersonic speeds from a non-nuclear detonation of a nuclear weapon. The model predicts the aerodynamic and chemical heat transfer rates and the particle thermal responses including the time and position of melt initiation. Due to the high Weber number environment, the melting particle undergoes liquid layer stripping. The theoretical model, which is incorporated in the PLUTO computer code, predicts the liquid mass loss rate, characteristic liquid droplet diameter, temperature rise acroes the liquid film, and the coupled particle trajectory.

8498 **(LA-UR—83-3329) Little Boy neutron spectrum below 1 MeV.** Evans, A.E. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 9p. (CONF-840202—6). NTIS, PC A02/MF A01. Order Number DE84003794.

From 17. midyear topical meeting of the Health Physics Society; Pasco, WA, USA (5 Feb 1984).

A high-resolution ^{3}He ionization chamber of the type development by Cuttler and Shalev was used to study the neutron spectrum from the Little Boy mockup. Measurements were made at distances of 0.75 and 2.0 m and at angles of 0°, 45°, and 90° with respect to the axis of the assembly, which was operated at power levels from 8.6 to 450 mW. Detector efficiency as a function of energy as well as parameters for correction of pulse-height distributions for proton-recoil and wall effects were determined from a set of response functions for monoenergetic neutrons measured at the Los Alamos 3.75-MeV Van de Graaff Accelerator Facility. Pulse-shape discrimination was used to separate ^{3}He-recoil pulses from the pulse-height distribution. The spectrum was found to be highly structured, with peaks corresponding to minima in the total neutron cross section of iron. In particular, 15% of the neutrons above the epithermal peak in energy were found to be in the 24-keV iron window. Lesser peaks out to 700 keV are also attributable to filtering action of the weapon's heavy iron casing. Data taken using experimental proton-recoil proportional counters are compared with the high-resolution spectra.

8499 **(LA-UR—83-3588) Critical commentary on dose-rate evaluations.** Dowdy, E.J.; Malenfant, R.E.; Plassmann, E.A. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 6p. (CONF-840202—10). NTIS, PC A02/MF A01. Order Number DE84004318.

From 17. midyear topical meeting of the Health Physics Society; Pasco, WA, USA (5 Feb 1984).

Survivors of Hiroshima and Nagasaki present a unique problem in dosimetry: the effects of radiation exposure may be inferred although the exposure itself is unknown. Experience with a replica of Little Boy demonstrates the difficulties of measuring dose rates, the problems of comparing measurements with calculations, and the inadequacy of the conventional standards that are used to calibrate dosimeters.

8500 **(LA-UR—83-3630) Comparison of calculations and measurements of neutron leakage from the Little Boy replica.** Forehand, H.M.; Whalen, P.P.; Malenfant, R.E. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 6p. (CONF-840202—7). NTIS, PC A02/MF A01. Order Number DE84004313.

From 17. midyear topical meeting of the Health Physics Society; Pasco, WA, USA (5 Feb 1984).

Measurements of the neutron leakage spectra from 0.6 to 10 MeV are compared with several calculations and earlier measurements of coarse models of Little Boy. Results indicate excellent agreement except at the nose of the device where the neutron exit path is longer, and neutron streaming through geometric discontinuities may present problems. As a result of the agreement, the long-standing difference between calculations and measurements of the Ichiban critical asembly can be resolved: the results reported in 1965 were not correct.

50 ENVIRONMENTAL SCIENCES, ATMOSPHERIC

8501 **(INIS-mf—8312) Aerosols in natural science, medicine and technology. Measurement techniques and technical application.** Junge, C.; Jaenicke, R. (eds.). (Gesellschaft fuer Aerosolforschung e.V., Bad Soden (Germany, F.R.)). 1978. 339p. (In German). (CONF-7710173—). NTIS (US Sales Only), PC A15/MF A01. Order Number DE84700214.

From Meeting on aerosols in natural science, medicine and technology-measurement techniques and technical application; Karlsruhe, F.R. Germany (26 Oct 1977).

The 5 conference of the "Association for Aerosol Research" was organized in the Kernforschungszentrum Karlsruhe during 26-28 October 1977. 54 papers were presented covering the main topic "Measuring technique and technical application" and other research fields. 160 participants came mainly from German speaking countries, but the conference could also attract colleagues from other countries, as Austria, Belgium, England, France, India, Jugoslavia, the Netherlands, Norge, Sweden, Switzerland, and the USA. The papers were presented orally as well as in a Poster Session. As Extended Abstracts 48 contributions were published in "Staub-Reinhaltung der Luft" v. 38(2) (1978). This volume of proceedings contains 45 papers. (orig.).

5001 Basic Studies

REFER ALSO TO CITATION(S) 8164, 8673

8502 **(CONF-8310220—3) Potential transport errors in single-layer wind fields.** Berkowitz, C.; Davis, W.; Knudson, D. (Pacific Northwest Lab., Richland, WA (USA); Argonne National Lab., IL (USA)). 1983. Contract W-31-109-ENG-38. 12p. NTIS, PC A02/MF A01. Order Number DE84003446.

From International specialty conference on the meteorology of acidic deposition; Hartford, CT, USA (16 Oct 1983).

An integral part of acid deposition modeling involves tracking the location of air parcels from source to receptor areas. Although a variety of trajectory computation methods may be used, all models must rely on meteorological data as a basis input. Potential errors in using wind data to represent transport of parcels include shear-induced changes in wind velocity with height. This paper presents the results of an analysis of potential errors associated with using single-layer average winds as opposed to multi-layer average values in trajectory simulations. The analysis compares wind fields from four distinct layers and a single layer-average value using data from seven upper air stations in the eastern US. Statistics generated from these data provide insight to the deviation from use of the individual versus single layer averages and the representativeness of the column value. Results of the analysis indicate that, although extreme differences can occur, over a reasonable period of time shear-induced errors in trajectory calculations should cancel. 1 reference, 5 figures, 2 tables.

8503 (DOE/EV/10097—5) Global temperature patterns 6000 years ago. Progress report. Webb, T. III. (Brown Univ., Providence, RI (USA). Dept. of Geological Sciences). Dec 1983. Contract AC02-79EV10097. 18p. NTIS, PC A02/MF A01. Order Number DE84004209.

A computer tape with the global set of paleoclimatic data for 6000 yr B.P. and contour maps of this information was prepared. Pollen, lake-level, and marine plankton data are the main types of data being compiled. Some new data from Alaska, eastern North America, South America, and the Indian Ocean were added to the data set. Maps are included that show temperature estimates for 6000 yr B.P. from over 200 sites in eastern North America and from over 250 sites in Europe. Patterns are evident on these maps, and certain regions, e.g., the Mediterranean and the eastern Canadian Arctic, may have had cooler temperatures at 6000 yr B.P. than today. The data are being prepared in a form that will make them useful to climate modelers. 13 references, 3 figures.

8504 (INIS-mf—8584, pp 177-184) NGD 621 sampler and NXZ 613 radioactive aerosol monitor. Dvorak, V.; Havlas, J.; Javornicky, K. (Tesla, Premysleni (Czechoslovakia). Vyzkumny Ustav Pristroju Jaderne Techniky). [nd]. (In Czech). NTIS (US Sales Only), PC A09/MF A01. (CONF-8105231—).

From Conference on nucleonic instruments and their use in the CSSR; Pribram, Czechoslovakia (18 May 1981).

Sampler NGD 621, designed for sampling aerosols and collecting iodine, was developed for environmental monitoring purposes. The device operates at ambient temperatures of -10 to +40 degC with a flow rate of ca. 1 $m^3.h^{-1}$. The samples of aerosols deposited on the filter or of adsorbed iodine can be evaluated using common evaluation instruments. Monitor NXZ 613 is designed for laboratory use, for monitoring radioactive aerosols in places where open sources are handled. It consists of two integral assemblies, viz., a detection unit and a control unit. Aerosols are trapped while air is forced through the filter. Natural radioactive aerosols which are also trapped on the filter form a background that may prevent identification of artificial radioaerosols. A pseudocoincidence method whose principle is described is used for limiting this effect.

5002 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 7137, 7186, 7217, 7249, 7691, 8550, 8565, 8627, 8650

8505 (CEA-N—2346) Thermal degradation of the vapours of organic nitrogen compounds in the presence of the air. Brault, A.; Chevalier, G.; Kerfanto, M.; Loyer, H. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France)). Apr 1983. 72p. (In French). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84750225.

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Following a quick survey of the literature on the products originated during the thermal degradation of some organic nitrogen compounds, the experimental results obtained by applying a technique previously used for other organic compounds are presented. The compounds investigated include: methyl and ethylamines at the origin of the bad smells of many gaseous wastes, trilaurylamine and tetraethylenediamine sometimes used in nuclear facilities. Attention is brought to the emission of noxious products during thermal degradation in the presence of the air, at various temperatures, viz. either usual combustion gases such as carbon monoxide or nitro-derivatives such as hydrogen cyanidew 850°C.

8506 (CONF-830617—15) Constituent source emission rate characterization of three gas-fired domestic ranges. Cole, J.T.; Zawacki, T.S.; Macriss, R.A.; Moschandreas, D.J. (Institute of Gas Technology, Chicago, IL (USA)). 1983. 18p. IGT, 3424 South State St. IIT Center, Chicago, Ill 60616.

From 76. annual meeting of the Air Pollution Control Association; Atlanta, GA, USA (19 Jun 1983).

Indoor air quality has come under scrutiny, in recent years, as a result of the need to reduce the rate of air infiltration of residential dwellings and, therefore, of the homeowner's space heating and air conditioning energy budget. Indoor air quality is influenced by outdoor air quality, the building structure and materials, consumer products, appliances, weather, occupant activities, etc. Along with other sources, unvented gas appliances are contributors of nitric oxide (NO), nitrogen dioxide (NO_2), carbon monoxide (CO), and of other air constituents. Source emission data from 18 gas ranges were published in 1974 showing an average NO/NO_2 emission factor ratio of about 0.33. More recent work has shown the NO_2/NO ratio to vary in the range of 0.4 to 2.0 and this disparity has been attributed to the differences in the experimental procedure used in each case. This paper presents new emission factor data for NO, NO_2, CO and of other trace constituents (TSP, VOC, PAH) from three modern gas ranges and provides a mechanism that helps explain the relatively high NO_2/NO ratios. The paper also presents average emission factor data for TSP and formaldehyde and shows that the difference in VOC and PAH emission rates (between the background and with range burners operating) is within the instrument precision limit. 5 references, 1 figure, 5 tables.

8507 (CONF-830662—2) Acidic deposition effects on vegetation: a review and analysis of methodology. Irving, P.M. (Argonne National Lab., IL (USA)). 1983. Contract W-31-109-ENG-38. 37p. NTIS, PC A03/MF A01. Order Number DE84004014.

From VDI Society of German Engineers conference on precipitation; Lindau, F.R. Germany (7 Jun 1983).

Acid rain has recently been implicated as an agent which may potentially impact (both positively and negatively) vegetative growth. Although numerous hypotheses have been published regarding long-term acid rain damage to forests and croplands, there are few research results to directly support conclusive estimations of impact. A description and analysis of the approach and techniques used by researchers examining the vegetative impacts of acid rain is presented. 26 references, 5 figures, 1 table.

8508 (CONF-8309130—4) Estimation of North America anthropogenic sulfur deposition as a function of source/receptor separation. Shannon, J.D. (Argonne National Lab., IL (USA)). 1983. Contract W-31-109-ENG-38. 8p. NTIS, PC A02/MF A01. Order Number DE84003638.

From 14. international technical meeting on air pollution modeling and its applications; Copenhagen, Denmark (27 Sep 1983).

All US and Canadian emissions of anthropogenic sulfur were combined and the deposition contributions from sources located within 200 km, from 200 to 500 km, from 500 to 1000 km, and more than 1000 km from each receptor were calculated separately. Local sources are shown to have a much greater relative contribution to dry deposition than to wet deposition. This is due to the fact that dry deposition, for a given surface and atmospheric stability, is directly proportional to surface concentration, which for a primary pollutant steadily decreases away from sources due to depletion and vertical dilution, while wet deposition is episodic and removes pollutants from a greater depth of the atmosphere. The influence of distant sources is seen to be relatively greater in eastern Canada than in the eastern US. This is due both to the less dense emission field in Canada and to the fact that much of eastern Canada is northeast of the major US and Canadian sources and thus downwind in the sense of the prevailing flow, particularly during summer. Results indicate that sulfur deposition results from a wide distribution of sources, particularly in the case of wet deposition. It can be inferred that a policy to reduce total sulfur deposition by a specified proportion in sensitive areas would not need to be as broadly based as a program to reduce wet deposition by that proportion since the relative local source contribution to dry deposition appears to be greater than that for wet deposition. 1 reference. (ACR)

8509 (CONF-8310179—5) New passive monitor for direct detection of PAH vapors. Vo-Dinh, T.; Miller, G.H. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 11p. NTIS, PC A02/MF A01. Order Number DE84003278.

From 8. international symposium on polynuclear aromatic hydrocarbons; Columbus, OH, USA (26 Oct 1983).

This paper reports on the combination of the principles of molecular diffusion, physical adsorption, and spectroscopic detection in the development of a new personnel dosimeter. This dosi-

meter is designed to monitor personnel exposure of workers to potentially hazardous vapors and fine aerosols of polynuclear aromatic (PNA) compounds. This dosimeter collects the PNA compounds via molecular diffusion and sorption. Collection is followed by direct identification and quantification of the analyte compounds via the room temperature phosphorescence (RTP) technique. There is no requirement for a prior chemical extraction or chemical desorption protocol. Results on the evaluation of the dosimeter for various homocyclic as well as heterocyclic PNAs during laboratory-controlled experiments and field tests are be illustrated. The suitability of this device as a new personnel monitor in the workplace is discussed. 11 references, 6 figures.

8510 **(DOE/CH/00016—1) Analysis of concepts for controlling atmospheric carbon dioxide.** Steinberg, M. (Brookhaven National Lab., Upton, NY (USA)). Dec 1983. Contract AC02-76CH00016. 68p. NTIS, PC A04/MF A01. Order Number DE84004203.

This analysis addresses the mitigation of the CO_2 effect mainly by controlling the CO_2 content in the atmosphere. It does not deal with alteration of the environment to cope with the CO_2 effect. The methodology is to first devise a logic for guiding the construction of the mitigating processes and systems. It is then necessary to ascertain the physical, chemical and biological properties required to design the mitigating systems. This is followed by an outline of the criteria for evaluating the process system and scenarios. Descriptions of specific process systems for obtaining the mitigating effects are then presented and preliminary evaluation is given for each of the process systems. In conjunction with the utilization of CO_2, a preliminary market projection is made to determine the magnitude of the effect of each of the projected uses on the control of CO_2. Finally a priority listing of recommended research and systems analysis studies are given based on the preliminary evaluations. 21 references, 5 tables.

8511 **(DOE/ER/60045—T1(Rev.)) Transport and fate of acid rains out of North America. Final report, April 14, 1982-April 13, 1983.** Knap, A.H. (Bermuda Biological Station, Ferry Reach). Oct 1983. Contract AC02-82ER60045. 28p. NTIS, PC A03/MF A01. Order Number DE84004705.

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A program to investigate the transport and fate of acid rains out of North America has been carried out by the collection and analysis of rainwater on Bermuda. Approximately 110 samples were collected and analyzed during the period of funding. Analysis of rainwater chemistry data collected in Bermuda since 1980 indicates that excess sulfate, nitrate and hydrogen ion correlate well with air mass trajectories emanating from North America. The analysis of data collected by ships in the western North Atlantic confirms that air masses from a westerly direction are more enriched with sulfate, nitrate and hydrogen ion than those from an easterly direction. A crude sulfur budget for the western North Atlantic has been developed and is presented.

8512 **(DOE/PC/30071—1) Receptor modeling of long range air pollutant transport.** Wolfinger, T.F.; Lubore, S.H. (Mitre Corp., McLean, VA (USA). METREK Div.). Oct 1983. Contract AC22-80PC30071. 121p. NTIS, PC A06/MF A01. Order Number DE84004686.

This report presents a state-of-the-art review of receptor modeling in the context of long-range air pollutant transport. Emphasis is placed on acid deposition as a long-range transport issue. The report includes: (1) an overview of receptor moeling techniues, (2) a review of past uses of receptor modeling in long-range air pollutant transport studies, (3) a discussion of issues that arise in using receptor modeling in such investigations and (4) suggestions for methodological research in receptor modeling and applications of existing techniques in acid deposition studies. The report also includes an extensive bibliography. 272 references, 6 figures, 4 tables.

8513 **(DP-MS—83-12-Rev.1) Sulfur dioxide, carbon dioxide, and water vapor flux measurements utilizing a microprocessor controlled data acquisition system in a pine plantation.** Lorenz, R.; Murphy, C.E. Jr. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1983. Contract AC09-76SR00001. 20p. NTIS, PC A02/MF A01. Order Number DE84004083.

A microprocessor-controlled data acquisition system was utilized to determine the flux densities of sulfur dioxide (SO_2), carbon dioxide (CO_2), and water (H_2O) vapor above a young loblolly pine plantation. Electrical noise, data transmission, and interfacing problems had to be solved before system startup. Data collection began in June 1982 and continued through May 1983. The average flux densities for SO_2, CO_2, and H_2O vapor for measurement periods scattered throughout the year, for this stand, were found to be 0.052 $\mu gm^{-2}sec^{-1}$, 0.72 $mgm^{-2}sec^{-1}$, and 85 $mgm^{-2}sec^{-1}$, respectively. The experimental design, system controls, measurement techniques, control logic, and some results obtained are discussed. 10 references, 8 figures.

8514 **(IFE/KR/E—82/008) Heavy metal exposure of human beings and environment from energy production. II. Collocation of Norwegian heavy metal data.** Brevik, E.M.; Christensen, G.C. (Institute for Energy Technology, Kjeller (Norway)). Oct 1982. 34p. (In Norwegian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84750114.

The report is a literature study covering available data regarding heavy metals in the Norwegian environment. The survey is limited to data related to the external environment such as air, water, soil, fodder plants and foodstuffs. The following elements are included in the investigation: As, Cd, Cr, Hg, Ni, Pb, Sb, V, Zn. The data may be of importance to the further work in a proposed main project regarding heavy metal exposure of human beings and environment from energy production. 11 tables. 143 references.

8515 **(NP—3770163) Emmission cadastre Lower Austria.** (Amt der Niederoesterreichischen Landesregierung, Vienna (Austria)). Jun 1982. 43p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83770163.

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The emission of sulphur dioxide and dust precipitation in the areas of Lower Austria which are most heavily polluted are indicated on maps of large areas. Emphasis was put on the industrial- and densely populated areas. The structure accordingly showed a west-east and a north-south axis, the greater Vienna area was covered as well here. In main industrial regions and in the unfluential sphere of large-scale emitters increased sulphur dioxide emissions were found in the 6 winter months. The recording of the sulphur dioxide emissions showed a good compatibility with the data of the emission cadastre Lower Austria.

8516 **(ORNL—5854) Physicochemical processes in the environment: background information for the ORNL Unified Transport Model for Toxicants (UTM-TOX).** Browman, M.G.; Patterson, M.R.; Sworski, T.J. (Oak Ridge National Lab., TN (USA)). Nov 1983. Contract W-7405-ENG-26. 140p. NTIS, PC A07/MF A01. Order Number DE84004108.

The ORNL Unified Transport Model for Toxicants (UTM-TOX) is a dynamic mathematical chemical fate and transport model. It represents the modification of the ORNL Unified Transport Model (UTM) by the incorporation of algorithms for the physicochemical processes typical of organic chemicals in the environment. A discussion of the general structure of the UTM-TOX and the theoretical background of the new algorithms, either now or soon to be installed, is presented. Aquatic, atmospheric, and terrestrial systems are discussed separately. The major processes presented are, by system: aquatic - adsorption-desorption, volatilization, photolysis, hydrolysis and biodegradation; terrestrial - adsorption-desorption, volatilization of surface and subsurface chemicals, and degradation; atmospheric - vapor phase-particulate and vapor phase-water partitioning, oxidation by OH radicals and ozone, and direct photolysis. Alternative approaches to the ones selected, future adaptations to improve the UTM-TOX, and research needs are also included in the discussion. 163 references.

8517 (ORNL/CDIC—6) Guide to the bibliographic format used by the Carbon Dioxide Information Center. Allison, L.J.; Pfuderer, H.A. (Oak Ridge National Lab., TN (USA)). Dec 1983. Contract W-7405-ENG-26. 61p. NTIS, PC A04/MF A01. Order Number DE84004109.

This document presents quidelines for the preparation of material to be entered into the Carbon Dioxide Information Center's Bibliographic Information System (CDIC/BIS). Literature included in a computerized information file has a number of identifying characteristics or descriptors. The descriptor fields currently used by the CDIC/BIS are alphabetically listed and are defined in detail. Many examples are included to illustrate some of the variations that might be encountered. 6 references.

8518 (PB—83-245738) Comparison of sulfur and nitrogen oxide emission rates with wet deposition rates in the state of Maryland. Campbell, S.; Arlauskas, M. (Martin Marietta Corp., Baltimore, MD (USA). Environmental Center). Jun 1983. 40p. NTIS, PC A03/MF A01.

Emissions inventories for the eastern United States indicate that Maryland is responsible for only 2 to 3% of the total emissions in the five-state area encompassing Maryland. For nitrogen, anthropogenic emissions in Maryland account for 11% of those in the five-state region. Two circumstances suggest that the bulk of the deposited sulfate is produced outside Maryland: 1) easterly transport winds in Maryland are relatively infrequent; 2) elevated sulfate concentrations in rain observed at Deep Creek are frequently associated with winds from the northwest. A review of the evidence indicates that on the average, local and deposition due to isolated power plants will increase sulfate and hydrogen ion deposition by no more than 10% annually within a 30-km radius of the plant (equivalent to a pH depression of 0.1 unit). However, locally greater deposition may occur at specific locations that are frequently impacted by rain traversing the plume.

8519 (PB—83-247437) Status of research to develop acidic dry deposition monitoring capability. Durham, J.L.; Hicks, B.B.; Wesely, M.L.; de Pena, R.G.; Thomson, D.R. (Environmental Protection Agency, Research Triangle Park, NC (USA). Environmental Sciences Research Lab.). Aug 1983. 12p. (EPA—600/D-83-093). NTIS, PC A02/MF A01.

Dry deposition is thought to be as important as wet deposition in acidifying ecosystems. However, at present acidic dry deposition of relevant particles and gases cannot be monitored directly in a quantitative manner. The U.S. EPA Workshop on Dry Deposition (Report No. EPA-600/9-80-050) recommended that dry deposition velocities be parameterized as a function of micrometeorology and surface type to permit the use of ambient pollutant concentration data for inferring dry flux ('concentration monitoring' technique). Also, the micrometeorological technique's variance, modified-Bowen ratio, and eddy accumulation were identified as candidates for development as dry flux monitors for network stations. This approach has been adopted by the task group on 'Deposition Monitoring of Acidic Substances' of the Interagency Task Force on Acid Precipitation. Research monitoring stations have been established at Oak Ridge, TN, Argonne, IL, and University Park, PA for the purpose of intercomparing 'concentration monitoring', the three previously identified micrometeorological techniques, and eddy correlation. Intercomparison tests are being performed for SO2, NO2, HNO3, NH3, O3, and particulate SO4(-2), NO3(-1), and NH4(+1). The status of methods development and performance is presented.

8520 (PNL-SA—11561) Parameterization of removal mechanisms. Hales, J.M. (Pacific Northwest Lab., Richland, WA (USA)). Jul 1983. Contract AC06-76RL01830. 36p. (CONF-831069—3). NTIS, PC A03/MF A01. Order Number DE84004831.

From 5. conference on atmospheric radiation; Baltimore, MD, USA (31 Oct 1983).

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Pollutant gases and aerosols are depleted from the Earth's atmosphere via three basic pathways: (1) physicochemical annihilation; (2) dry deposition; and (3) precipitation scavenging. While all three of these pathways can be mechanistically complex, the general techniques for parameterization of the first are reasonably straightforward and rather widely accepted. This situation is not true, however, in the cases of dry deposition and precipitation scavenging, where at the present a rather diverse range of loosely-defined parameterization methods is being applied. This paper presents a general overview of parameterization methods currently applied in urban and regional models to characterize dry deposition and precipitation scavenging. These and possible future methods are discussed in detail. 19 references, 8 figures.

8521 (PNL-SA—11798) Detecting changes over time in annual sulfate deposition in a geographical area. Olsen, A.R.; Simpson, J.C.; Watson, C.R. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1983. Contract AC06-76RL01830. 12p. (CONF-831147—1). NTIS, PC A02/MF A01. Order Number DE84004844.

From National atmospheric deposition program; Knoxville, TN, USA (7 Nov 1983).

Annual 1979 and 1980 sulfate deposition data for 21 NADP monitoring stations with at least 20 weekly samples and with samples from each quarter are used to investigate the magnitude of change that is detectable in a statistical sense with high confidence. A statistical technique called Kriging is applied to obtain block area estimates and standard errors for average sulfate deposition. The block area covers most of New York, Connecticut, Rhode Island, Pennsylvania, West Virginia and Ohio. The estimates obtained are 35.0 kg/ha (3.5 g/m^2) and 31.8 kg/ha (3.2 g/m^2) for 1979 and 1980, respectively. The associated standard errors are 2.1 kg/ha (0.2 g/m^2) for both 1979 and 1980. Estimates of the minimum magnitude of annual sulfate deposition change detectable with 90% confidence are 8.8, 5.1 and 3.9 kg/ha (0.88, 0.51 and 0.39 g/m^2) when one, three and five years, respectively, of annual data are available before and after an intervention occurs. These estimates are based on optimum conditions and may be lower than minimum change detectable in practice. For example, the presence of trends or cycles in annual deposition would increase the minimum change detectable. An increase in the number of monitoring stations will provide additional information but not directly proportional to the increase. A preliminary estimate of the effect of doubling the number of monitoring stations is that the minimum detectable limit is 60% of the previous estimates. For one year before and after this reduces the value to 5.3 kg/ha compared to 8.8 kg/ha. 1 figure, 3 tables.

8522 Acid rain: clarifying the scientific unknowns: an overview. Wayne, M.; Perhac, R.; Males, R.; Yeager, K. *EPRI (Electric Power Research Institute) Journal;* 8: No. 9, 7-15(Nov 1983).

An overview.

The physical/chemical phenomenon of acid rain is examined. The author scans some of the major scientific questions surrounding it, the options for controlling or mitigating its effects, and the research now planned or under way to shed light on its scientific unknowns. The complexities are noted of trying to resolve a scientific problem that has inherent economic and political dimensions on an international scale. 7 figures.

8523 Acid rain: tracing the pathways of atmospheric conversion. Moore, T.; Allan, M.A.; Goldstein, R.; Hilst, G.; Huckabee, J.; Mueller, P.; Patterson, R.; Perhac, R. *EPRI (Electric Power Research Institute) Journal;* 8: No. 9, 16-26(Nov 1983).

Sources and transport.

The Electric Power Research Institute (EPRI) is currently involved in supporting tracer experiments that attempt to clarify how atmospheric processes affect emissions transport and chemical conversion in an attempt to better estimate the most likely sites for acidic deposition. The experiments deal with both emissions and atmospheric transport to gain their results. Adequate controls cannot be established until atmospheric conversion and pollutant deposition are fully understood. Special emphasis is given to the source-receptor relationship between acid-producing pollutants and acidic deposition and the specific experiences Europe has been having with the problem. 11 figures.

8524 **Acid rain: discerning the change in waters and woodlands.** Lihach, N.; Brocksen, R.; Goldstein, R.; Huckabee, J.; Kawaratani, R.; Mattice, J.; Murarka, I.; Perhac, R. *EPRI (Electric Power Research Institute) Journal;* 8: No. 9, 28-39(Nov 1983).

Environmental effects.

The research being done to establish the effects of acid rain on the earth's waters and woods is presented. It is pointed out that definitive answers cannot be possible because of the lack of scientifically credible, consistent, long-term data on trends. Various specific programs now under way to collect adequate data are highlighted. Researchers are not yet able to predict an area's susceptibility to acidic rain damage, but are more confident that acid rain is only a minimal threat to the earth's water and soil ecosystems. 13 figures.

8525 **Federal acid rain research.** Hollander, E. (Electric Power Research Inst., Washington, DC). *EPRI (Electric Power Research Institute) Journal;* 8: No. 9, 52-56(Nov 1983).

Washington report.

As a result of the Acid Precipitation Act of 1980, the National Acid Precipitation Assessment Program became the focus of the US Interagency Task Force on Acid Precipitation. The Task Force is composed of twenty members which represent twelve federal agencies and departments as well as other public, private, and academic groups concerned with the problems of acid rain. Nine research categories have been established by the task force in an effort to plan and implement an integrated effort to collect preexisting acid rain research data for assessment and to coordinate future efforts: natural sources; man-made sources; atmospheric processes; deposition monitoring; aquatic effects; terrestrial effects; effects on materials and cultural resources; assessments and policy analysis; and control technologies. The organization and workings of each group individually and collectively is explained. 1 figure.

8526 **Small-scale combustion testing.** Gibbon, G.A.; Ekmann, J.M.; White, C.M.; Navadauskas, R.J.; Retcofsky, H.L.; Joubert, J.I. (US Dept. of Energy, Pittsburgh, PA). *ACS Symposium Series;* No. 217, 223-239(1983).

From 183. meeting of the American Chemical Society; Las Vegas, NV, USA (28 Mar 1982).

In order to assess the possible environmental impact of substituting synfuels for petroleum in utility and industrial boilers, two experimental programs have been undertaken at the Pittsburgh Energy Technology Center. First, a fully instrumented 20-hp firetube boiler capable of burning liquid fuels ranging in combustion characteristics from No. 2 to No. 6 petroleum has been installed in the Combustion Division. Second, a sampling and analytical methodology for the organic compounds present in the exhaust duct of the 20-hp boiler is being developed by the Analytical Chemistry Division. This report outlines the progress on this project to date: twenty-four successful combustion runs have been completed on the 20-hp boiler, using a variety of petroleum-based fuels and synfuels; a sampling protocol for organic vapors in hot exhaust gases has been developed; significant differences in the composition of the trace organics in the exhaust gases have been observed as a function of the fuel being burned, but total polynuclear aromatic hydrocarbon levels are comparable for all fuels. 6 references, 10 tables.

5003 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 8544

8527 **(DOE/ER/60095—T1) Source characterization and transport processes affecting levels of radon and its decay products in an indoor environment. Annual report.** Wilkening, M.; Schery, S.D. (New Mexico Inst. of Mining and Technology, Socorro (USA). Dept. of Physics). 5 Jan 1984. Contract AC04-82ER60095. 5p. NTIS, PC A02/MF A01. Order Number DE84004237.

Research progress in the following areas is reported: (1) exhalation of radon and thoron from soil at a field station; (2) measurements of indoor radioactivity; (3) instrumentation development for measurement of radon, thoron, and their daughters; (4) radon levels in indoor and outdoor locations measured with passive track-etch detectors; (5) ion-aerosol interactions; and (6) a study of radon levels and their use for measuring air exchange in caves. (ACR)

8528 **(EGG-PBS—6479) Radiation Measurements Laboratory (RML) calibration and assessment of the ATR SPING-3 stack effluent monitor.** Koeppen, L.D.; Rogers, J.W.; Simpson, O.D. (Idaho National Engineering Lab., Idaho Falls (USA)). Dec 1983. Contract AC07-76ID01570. 32p. NTIS, PC A03/MF A01. Order Number DE84004236.

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An evaluation, calibration and assessment of the Eberline SPING-3 ATR stack effluent monitor was conducted. This unit which monitors particulate, iodine and noble gas effluents was producing abnormal results following the initial installation and operational testing. The purposes of this work were to find the causes of the abnormal results and correct them if possible; check the calibrations and adjust them if necessary; and to provide a better in-depth understanding of what the unit is monitoring and how well it performs under this application. Results have shown that there were some problems associated with the unit as initially installed and tested. These problems have been identified and suggested alternatives shown, the monitor was found to be applicable to some extent under the current conditions. The calibrations have been checked and adjustments made. More operation testing and evaluation is needed to assess how well this works under a variety of ATR operating conditions. 2 references, 10 figures, 3 tables. (ACR)

8529 (INIS-mf—8299, pp 194-195) **Retrospect on the work of the Aussenstelle Freiburg/Schauinsland.** Weiss, W.; Stockburger, H.; Sartorius, H. 1983. (In German). NTIS (US Sales Only), PC A05/MF A01.

In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

Since April 1, 1982, the Aussenstelle at Freiburg/Schauinsland of the Max-Planck-Institut fuer Kernphysik is incorporated into the Bundesamt fuer Zivilschutz at Bonn. This report summarizes the past and present investigations performed at the Aussenstelle. (orig.).

8530 **(NUREG/CR—3344) MESOI Version 2.0: an interactive mesoscale Lagrangian puff dispersion model with deposition and decay.** Ramsdell, J.V.; Athey, G.F.; Glantz, C.S. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1983. Contract AC06-76RL01830. 223p. (PNL—4753). NTIS, PC A10/MF A01 - GPO $6.50. Order Number DE84004562.

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MESOI Version 2.0 is an interactive Lagrangian puff model for estimating the transport, diffusion, deposition and decay of effluents released to the atmosphere. The model is capable of treating simultaneous releases from as many as four release points, which may be elevated or at ground-level. The puffs are advected by a horizontal wind field that is defined in three dimensions. The wind field may be adjusted for expected topographic effects. The concentration distribution within the puffs is initially assumed to be Gaussian in the horizontal and vertical. However, the vertical concentration distribution is modified by assuming reflection at the ground and the top of the atmospheric mixing layer. Material is deposited on the surface using a source depletion, dry deposition model and a washout coefficient model. The model also treats the decay of a primary effluent species and the ingrowth and decay of a single daughter species using a first order decay process. This report is divided into two parts. The first part discusses the theoretical and mathematical bases upon which MESOI Version 2.0 is based. The second part contains the MESOI computer code. The programs were written in the ANSI standard FORTRAN 77 and were developed on a VAX 11/780 computer. 43 references, 14 figures, 13 tables.

8531 **(NUREG/CR—3368) Diffusion rates for elevated releases.** Ramsdell, J.V. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1983. Contract AC06-76RL01830. 30p. (PNL—4772). NTIS, PC A03/MF A01 - GPO $3.75. Order Number DE84004277.

A search of the literature related to diffusion from elevated sources has determined that an adequate data base exists for use in developing parameterizations for estimating diffusion rates for ma-

terial released from free standing stacks at nuclear power plants. A review of published data analyses indicates that a new parameterization of horizontal diffusion rates specifically for elevated releases is not likely to significantly change the magnitudes of horizontal diffusion coefficients on the average. However, the uncertainties associated with horizontal diffusion coefficient estimates under any given set of atmospheric conditions could be reduced by a new parameterization. Similarly, a new parameterization of vertical diffusion rates would be unlikely to significantly alter the magnitudes of diffusion coefficients for unstable atmospheric conditons. However, for neutral and stable atmospheric conditions, a new parameterization of vertical diffusion rates might increase vertical diffusion coefficients significantly. The increase would move ground-level time-integrated concentration maxima closer to the plant and would increase the maxima. 55 references, 2 figures, 4 tables.

8532 **(ORNL-tr—5065) Method for the instant approximation of atmospheric dispersion.** Doury, A. (Oak Ridge National Lab., TN (USA); CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France)). [nd]. Contract W-7405-ENG-26. Translation of IAEA-SR-85/23, 1983. 15p. NTIS, PC A02/MF A01. Order Number DE84004835.

Mathematical evaluations of the radiologic impact of the transfer to man of radionuclides liberated into the environment are made with complex chains of models in which an early and essential link is always that of dispersion in air or water where the basic evaluations involve concentrations. In practice it often happens that the link of the concentration in the physical environment is overdeveloped in comparison to the other links and that the corresponding models are unnecessarily complicated. It appeared useful to develop a very simple basic primary model with few disagreements compatible with all of the existing models that it does not presume to replace. Naturally this model implies a certain number of stringent simplifying hypotheses, but at each point of space or time it only has a single parameter, the mixture thickness, real or equivalent, to characterize turbulent diffusion. A basic formula covering the short- and long-term situations, as well as transfers both within the atmosphere and to the ground (deposits) is supplied in the form of a single summary table. 4 references, 1 figure, 1 table.

5005 Site Resource And Use Studies

8533 **(MST-LUFT-A—69) Observations of tropospheric aerosol in Greenland. A survey for period 1979-1980.** Heidam, N. Zeuthen. (Miljoestyrelsen, Roskilde (Denmark). Luftforureningslab.). Feb 1983. 10p. (In Danish). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750086.

Atmospheric aerosol samples have been collected through a year at five locations in Greenland. The samples have been analyzed by PIXE to determine the elemental composition of the Arctic aerosol. The results for one of the stations are described in detail and related to those obtained at the other sites. Annual and monthly geometric means of the concentrations in the aerosol of the elements Al, Si, S, Cl, K, Ca, Ti, Cr, Mn, Fe, Ni, Cu, Zn, Br, Sr, and Pb are reported. The results have been subjected to factor analyses, which show that the Arctic aerosol can be considered to be composed of at most 5 different components, the characteristics of which are described. The components consist of 3 different anthropogenic and a crustal component and, in addition, a sea salt component at sites exposed to open seas within mesoscale distances. Possible origins of the various components are discussed in view of the seasonal variations of the factor estimates, their statistical independence, and their relation to a selection of synoptic situations. It is concluded that the high Arctic troposphere in winter constitutes a well mixed aerosol reservoir which in most cases maks the origins in distant source areas.

5006 Regulations

REFER ALSO TO CITATION(S) 7691

8534 **(PB—83-242537) Maps depicting nonattainment areas pursuant to Section 107 of the Clean Air Act - 1983.** Duggan, G.; Pearson, J.; Beal, W. (Engineering-Science, Inc., Durham, NC (USA)). Feb 1983. 240p. NTIS, PC A11/MF A01.

This report is a detailed mapping of the United States Depicting those areas not attaining the National Ambient Air Quality Standards for carbon monoxide, nitrogen dioxide, ozone, sulfur dioxide and total suspended particulates. It includes nonattainment area maps and supporting lists from Federal Register publications for final actions through February 1, 1983.

51 ENVIRONMENTAL SCIENCES, TERRESTRIAL

5101 Basic Studies

REFER ALSO TO CITATION(S) 8594

5102 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 7689, 8514, 8516, 8565, 8627, 8628

8535 **(NE-FBA—83-3) Emissions from combustion of peat and wood-chips.** Rudling, L.; Loefroth, G. (Naemnden foer Energiproduktionsforskning, Stockholm (Sweden)). 1981. 50p. (In Swedish). (SNV-PM—1449). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84750111.

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The emissions from the following combustion systems have been investigated: powdered peat in a thermal power plant equipped with electrostatic precipitation; wood-chips in a cyclone prechamber oven equipped with electrostatic precipitation; and wood-chips in a hot water boiler equipped with a multiple-cyclone collector. The emissions were characterized with respect to carbon, nitrogen and sulfur oxides, particulates, a number of metals, total gas phase hydrocarbons, ethene, benzene, formaldehyde, acetaldehyde, chlorobenzenes, chlorophenols, a number of PAH, amount of extractable organic matter and mutagenicity in the Salmonella test. The sampling comprised particulate matter, aqueous condensate, and non-condensed compounds. Peat gave stable conditions with a low level of carbon monoxide and organic compounds. The wood-chips gave relatively high emissions of organic compounds and carbon monoxide in the flue gases. The emissions of PAH and the mutagenicity of extractable compounds are in agreement with an earlier study. The mutagenicity assays show that nitro- and/or nitroso-substituted polycyclic or heterocyclic hydrocarbons are present in the emission samples from the wood-chips combustion systems.

8536 **(UCID—19945) Assessment of the extent of trichloroethylene contamination of soil and water at Lawrence Livermore National Laboratory Site 300.** Carpenter, D.W.; Stone, R.; Ragaini, R.C.; McConachie, W.A.; Crow, N.B.; Elwood, R. (Lawrence Livermore National Lab., CA (USA)). 29 Sep 1983. Contract W-7405-ENG-48. 120p. NTIS, PC A06/MF A01. Order Number DE84004701.

A study has been conducted to determine the extent of trichloroethylene (TCE) contamination of soil and rock and of ground water in the saturated zone at locations of concern at Lawrence Livermore National Laboratory Site 300 located 13 miles southeast of Livermore, California. An exploratory investigation involving surface reconnaissance, geologic mapping, observation and sampling of surface runoff for TCE analysis, exploratory drilling and sampling of soil and rock for TCE analysis, and observation well construction and ground-water sampling for TCE analysis has been completed. The only substantial TCE contamination of soil, rock, and ground water was found in the Building 834 area. A small

perched, contaminated ground water body located in a sparingly permeable sand and gravel unit there is isolated from the reional ground-water system by a clay-silt aquitard that largely prevents its downward movement. The perched ground-water body apparently discharges very slowly to the hillside below the Building 834 complex where it evaporates. Small quantities of TCE were also detected in soil and rock samples from the Building 854 area and at Building 830. Building 830 is identified as the most likely source of the TCE found in water samples taken from Spring 3.

5103 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 7285, 7295, 7305, 7306, 7307, 7309, 7328, 7689

8537 **(CONF-830610—3) Improved method of ^{241}Am analysis for Nevada Test Site soils.** Larsen, I.L.; Lee, S.Y.; Tamura, T. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 12p. NTIS, PC A02/MF A01. Order Number DE84003164.

From Nevada Applied Ecology Group transuranics (and associated radionuclides) information conference; Las Vegas, NV, USA (28 Jun 1983).

A direct nondestructive method of analysis for ^{241}Am utilizing photon counting and self-absorption correction factors is presented. Using Nuclear Site 201 soils, comparisons were made among results analyzed by radiochemical-alpha spectrometry, a conventional Ge(Li) detector, and an intrinsic germanium (IG) planar detector with a thin beryllium window. The sensitivity in using the IG planar detector for photon counting provides an improvement factor between three to four times in comparison to that of the conventional Ge(Li) detector. The use of self-absorption correction factors provides an accuracy comparable to that obtained by radiochemical-alpha spectrometry techniques. The improved method is relatively simple, rapid, and accurate. Estimating ^{239}Pu concentrations from ^{241}Am measurements will achieve considerable savings in time and effort compared to Pu alpha-spectrometry. 4 references, 3 tables.

8538 **(DOE/EV/01643—150) Studies in iodine metabolism. Progress report, 1982-1983.** Van Middlesworth, L. (Tennessee Univ., Memphis (USA). Center for Health Sciences). 1983. Contract AS05-76EV01643. 20p. NTIS, PC A02/MF A01. Order Number DE84004925.

Research progress is reported for the period 1982 to 1983 in the following areas: (1) monitoring of animal thyroids for ^{129}I, ^{125}I, ^{131}I, ^{226}Ra, and ^{228}Ra; and (2) neonatal hypo-l thyroidism in laboratory rats. (ACR)

8539 (INIS-BR—78, pp 67) **Mobility and exchangeable fraction of ^{226}Ra and ^{210}Pb in planting soils in Pocos de Caldas, MG state, Brazil.** Oliveira, A.E. de; Teixeira, V.S.; Franca, E.P. (Rio de Janeiro Univ. (Brazil). Inst. de Biofisica). 1982. (In Portuguese). NTIS (US Sales Only), PC A07/MF A01. (CONF-821254—Summ.).

From 7. annual congress of the Brazilian Biophysics Society; Rio de Janeiro, Brazil (15 Dec 1982).

Published in summary form only.

8540 (INIS-BR—78, pp 69) **Cesium-137 in milk and pasture from farms of Angra dos Reis, RJ state, Brazil.** Castro, M.B. de; Franca, E.P. (Rio de Janeiro Univ. (Brazil). Inst. de Biofisica). 1982. (In Portuguese). NTIS (US Sales Only), PC A07/MF A01. (CONF-821254—Summ.).

From 7. annual congress of the Brazilian Biophysics Society; Rio de Janeiro, Brazil (15 Dec 1982).

Published in summary form only.

8541 (INIS-BR—86, pp 259-260) **Mobility and exchangeability of ^{226}Ra and ^{210}Pb in agriculture soils from the region of Pocos de Caldas, MG.** Oliveira, A.E. de; Teixeira, V.S.; Franca, E.P. (Rio de Janeiro Univ. (Brazil). Inst. de Biofisica). 1983. NTIS (US Sales Only), PC A15/MF A01. (CONF-830396—).

From Meeting on radiological protection and dosimetry; Itaipava, Brazil (21 Mar 1983).

Some aspects of the ^{226}Ra and ^{210}Pb transit in agriculture soils, are investigated.

8542 (INIS-BR—86, pp 261-262) **Radium, leaching, transport and retention at Morro do Ferro, Pocos de Caldas,** M.G. Franca, E.P.; Campos, M.J.; Carlos, M.; Lobao, N.; Pfeiffer, W.C.; Trindade, H. (Rio de Janeiro Univ. (Brazil). Inst. de Fisica). 1983. NTIS (US Sales Only), PC A15/MF A01. (CONF-830396—).

From Meeting on radiological protection and dosimetry; Itaipava, Brazil (21 Mar 1983).

The mechanisms of radium leaching transport and retention of the Morro do Ferro, are investigated.

8543 **(PNL-SA—11782) Dissolution of uranium and plutonium particles: simulations using the Mercer equation.** Cowan, C.E.; Jenne, E.A. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1983. Contract AC06-76RL01830. 41p. (CONF-831106—20). NTIS, PC A03/MF A01. Order Number DE84004838.

From Topical meeting on safeguards technology - the process safeguards interface; Hilton Head Island, SC, USA (28 Nov 1983).

There is a need to be able to predict the amount of plutonium that will be in solution at a given time from dissolution of particles in order to better predict the environmental behavior and possible adverse effects of plutonium spills. The equation developed by Mercer (1967) to simulate the dissolution of particles in lungs was parameterized and used to simulate the dissolution of a population of plutonium or uranium particles in the soil. Parameter values for the size distribution of particles in soil, and the density of the particles were found; however, values for the shape factors, and the dissolution rate were virtually non-existent. The calculated mass dissolved was most sensitive to the median diameter of the population of particles and least sensitive to the geometric standard deviation. A given percent change in the shape parameter and the dissolution rate resulted in approximately an equal percent change in the mass dissolved. Provided that the population of particles follows a log-normal distribution, the particles are homogeneous in composition and the dissolution can be represented by first-order kinetics, this equation can probably be applied with slight modification to estimate the mass dissolved at a given time. 66 references, 7 figures, 4 tables.

8544 **Variation of components in the radiation balance over different fynbos vegetation types.** Morris, M.I. Cape Town, South Africa; Cape Town University (1981). 144p. Available from the Registrar, University of Cape Town, University Private Bag, Rondebosch, 7700.

The primary aim of this research is to test whether fynbos vegetation has a high reflection coefficient, and the secondary aim is to consider the vegetation at the sites where the radiation measurements were carried out in order to determine whether similar vegetation structural types have similar radiation regimes. In order to do this six sites were selected in the Cape of Good Hope Nature Reserve. At each site the radiation fluxes were measured for three days during the late summer, giving a total of eighteen days of observation. In addition to the radiation measurements structural data was collected for the vegetation at each site so that comparisons between the radiation fluxes and vegetation could be made. Floristic data was also collected, to typify the vegetation at each site. It has been found that fynbos vegetation, as represented by this study, has an unusually low reflection coefficient which varies from 0,08 - 0,13. These values are below those recorded in the literature for other heathland vegetation. On the basis of a numerical classification of the vegetation structural data, it has been found that there is no clear relationship between the vegetation and the various components of the radiation balance.

5105 Site Resource And Use Studies

REFER ALSO TO CITATION(S) 7264, 7282

8545 **(DOE/EV/10468—T1) Test of the use of LANDSAT imagery to detect changes in the area of forests in the tropics.** Woodwell, G.M.; Hobbie, J.E.; Houghton, R.A.; Melillo, J.M.; Stone, T.A. (Marine Biological Lab., Woods Hole, MA (USA). Ecosystems Center). Sep 1983. Contract AC02-80EV10468. 39p. NTIS, PC A03/MF A01. Order Number DE84004444.

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Rates of change in the area of tropical moist forest in the Brazilian State of Rondonia in the southwestern Amazon Basin were measured over several years using LANDSAT data. The purpose was to test in the tropics a technique of change detection developed in temperate forests. The entire procedure was tested from the availability of imagery on computer tapes through the details of the analysis. Imagery was available and obtained readily from the Brazilian Institute of Space Studies (INPE). Three LANDSAT scenes were used to detect and measure change: June 1976, August 1978 and May 1981. Results showed within the area of one LANDSAT scene (34,000 km^2) rates of deforestation of 26,900 ha/y from 1976 to 1978 and 55,200 ha/y from 1978 to 1981. The LANDSAT data were used with 1981 data from the NOAA7 satellite (1 km resolution) to show in a preliminary estimate that 12,650 km^2 of forest had been cleared in Rondonia prior to 1981. A survey of LANDSAT data available from tropical regions around the world showed that there is ample data for a LANDSAT-based evaluation of deforestation for the period 1972 to 1982 for Amazonia, Central Africa and mainland Southeast Asia. The evaluation of deforestation in insular Southeast Asia would be more difficult by LANDSAT currently due to high cloud cover in the region. 10 references, 10 figures, 2 tables.

52 ENVIRONMENTAL SCIENCES, AQUATIC

5201 Basic Studies

REFER ALSO TO CITATION(S) 8106, 8107, 8147, 8418, 8668

8546 **(DOE/EV/00639—25) Flux of energy and essential elements through the Continental Shelf ecosystem. Progress report, June 1, 1983-May 31, 1984.** Pomeroy, L.R. (Georgia Univ., Athens (USA). Inst. of Ecology). 1 Dec 1983. Contract AS09-76EV00639. 34p. NTIS, PC A03/MF A01. Order Number DE84004965.

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The summer of 1981 was one of unusually intense intrusion of cold Gulf Stream subsurface water onto the southeastern continental shelf, not only off northern Florida, where summer intrusions are frequent, but off Georgia as well. Numbers of free bacteria were 10^6/ml over most of the continental shelf throughout the period of observation. These high numbers, an order of magnitude above usual numbers for the outer shelf, were associated with both newly arrived intrusions and old, stranded intrusions. Our third study of the coastal water and coastal front (FRNFLX II) in April 1981 showed that microbial numbers and heterotrophic activity are quite uniformly and continuously high in the coastal water and in water on both sides of the coastal front. Heterotrophic uptake of glucose shows that microorganisms are not substrate limited but probably are limited by protozoan grazers. The populations appear to be in steady state at high rates of production. Numbers of bacteria attached to particles are high in the coastal water compared with the water of the outer shelf, even during periods of Gulf Stream intrusion. 21 references, 11 figures, 2 tables.

5202 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 7139, 7249, 8514, 8516, 8536, 8565

8547 **(NP—4750090) Ash island in the Jammerland Bay. Deposition of fly ash in a marine environment. Main report. Environmental consequence of disposal of fly ash from coal-fueled power plants in an ash island.** Hjelmar, O.; Kusk, K.O.; Reuss, M.; Neergaard Jacobsen, B.; Birklund Andersen, J.; Larsen, L. (Vandkvalitetsinstituttet, Hoersholm (Denmark)); Rasmussen, P.; Dietrich, J.; Nielsen, T.K. (Dansk Hydraulisk Institut, Hoersholm). (Vandkvalitetsinstituttet, Hoersholm (Denmark)). 1983. 105p. (In Danish). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84750090.

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In order to evaluate the environmental impact of a proposed artificial marine island of deposited coal fly ash located off the western coast of Sealand, Denmark, a comprehensive research project has been carried out. The activities have comprised investigations of the hydraulic condition of the surrounding waters, chemical and physical characterization of fly ash, characterization of ash pond effluents, chemical, physical and hydrogeological investigations at old ash ponds, laboratory leaching tests, ecotoxicological tests, investigations of bioaccumulation of trace elements, and a survey of other sources of pollutants in the area. From the investigations it is concluded that while the ash is being deposited no long term toxic effects or significantly elevated concentrations of trace elements will result outside a 5 km^2 area surrounding the island. After a period of 20 - 25 years, when all the fly ash has been deposited, no significant environmental effects are expected to occur even within distances of a few meters from the island.

8548 **(NUREG/CR—2621) ESTONE: a computer code for simulating fast-transient, one-dimensional hydrodynamic, thermal, and salinity conditions in controlled rivers and tidal estuaries for the assessment of the aggregated impact of multiple power plant operation.** Eraslan, A.H. (Oak Ridge National Lab., TN (USA)). Nov 1983. Contract W-7405-ENG-26. 853p. (ORNL—5691). NTIS, PC A99/MF A01 - GPO $14.00. Order Number DE84004279.

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A one-dimensional transient model is developed for predicting flows and transport in rivers and estuaries. The model utilizes the discrete-element numerical scheme to solve the diferential equations governing the conservation of mass, momentum, energy (temperature), and salinity or pollutant concentration. The model is more realistic than most one-dimensional models, in that it utilizes three-dimensional channel geometry and approximates lateral and vertical variations of dependent variables as power laws. The computer code integrates these variations over the actual channel geometry, resulting in a one-dimensional model which realistically reflects three-dimensional effects. The computer code is efficient and can be used for long-term simulations over long river reaches. The model is particularly useful for establishing transient boundary conditions which can be used as input for two- or three-dimensional models applied to smaller regions of interest, such as regions near power plant intakes or discharges. 85 references.

8549 **(NUREG/CR—3408) Organohalogen products from chlorination of cooling water at nuclear power stations.** Bean, R.M. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1983. Contract AC06-76RL01830. 173p. (PNL—4788). NTIS, PC A08/MF A01 - GPO $6.00. Order Number DE84004274.

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Eight nuclear power units at seven locations in the US were studied to determine the effects of chlorine, added as a biocide, on the composition of cooling water discharge. Water, sediment and biota samples from the sites were analyzed for total organic halogen and for a variety of organohalogen compounds. Haloforms were discharged from all plants studied, at concentrations of a few μg/L (parts-per-billion). Evidence was obtained that power plants with cooling towers discharge a significant portion of the haloforms formed during chlorination to the atmosphere. A complex

mixture of halogenated phenols was found in the cooling water discharges of the power units. Cooling towers can act to concentrate halogenated phenols to levels approaching those of the haloforms. Examination of samples by capillary gas chromatography/mass spectrometry did not result in identification of any significant concentrations of lipophilic base-neutral compounds that could be shown to be formed by the chlorination process. Total concentrations of lipophilic (Bioabsorbable) and volatile organohalogen material discharged ranged from about 2 to 4 μg/L. Analysis of sediment samples for organohalogen material suggests that certain chlorination products may accumulate in sediments, although no tissue bioaccumulation could be demonstrated from analysis of a limited number of samples. 58 references, 25 figures, 31 tables.

8550 **(PNL-SA—11924) Identification and characterization of watershed models for evaluation of impacts of climate change on hydrology.** Shafer, J.M.; Skaggs, R.L. (Pacific Northwest Lab., Richland, WA (USA)). Dec 1983. Contract AC06-76RL01830. 90p. NTIS, PC A05/MF A01. Order Number DE84005049.

The identification and characterization of rainfall/snowmelt-runoff models was conducted to assist in research of the effects of a carbon dioxide-induced climate change on hydrology and freshwater resources. To understand the effect of a climate change on the supply and use of freshwater resources it is first necessary to understand the effect of such a change on runoff. Specific watershed models representing the broad range of existing modeling technology were evaluated in detail. Results of the analysis indicate that a wide range of watershed modeling capability exists. Results also indicate that, with the availability of digital computers capable of efficently handling large computational requirements, the level of modeling sophistication is greater than the available data necessary to support complex modeling. There is evidence, however, that this gap is closing with the development of more sophisticated data gathering and data management technology. 97 references, 5 figures, 4 tables.

5203 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 7272, 7285, 7290, 7295, 7296, 7298, 7305, 7306, 7328, 8097, 8102, 8104, 8542, 8543

8551 **(CEA-R—5215) Preliminary observations of the radioactive properties of matter in suspension in the Rhone river after desilting of upstream reservoirs.** Maubert, H.; Picat, P. (CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-les-Durance (France)). Mar 1983. 35p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84750226.

This paper discusses the measurements made at four stations along the Rhone River (Creys-Malville, Lyon, Viviers and Vallabregues) when the Seyssel reservoir sluice gates were opened for desilting purposes in June, 1980. Transit times in the upper Rhone are estimated from the observed turbidity peaks. The effects of the suspended matter on the physicochemistry of the water are analyzed. Measurements of the radioactivity in suspension at each of the four stations provide data for assessing the impact of radioactive waste discharges into the river. Concerning specific radionuclides, cesium-137 and cobalt-60 were detected at Lyon, while cesium-137, cesium-134, cesium/praseodymium-144, ruthenium/rhodium-106, manganese-54 and cobalt-60 were found at VALLABREGUES. Finally, the distribution coefficient Kd was computed for two nuclides, cesium and ruthenium, and compared with laboratory results.

8552 **(DOE/EV/00890—T5) Source and distribution of radon-222 and radium-226 within South Atlantic Bight waters.** Ramsey, E. (Georgia Inst. of Tech., Atlanta (USA)). Sep 1982. Contract AS09-76EV00890. 86p. NTIS, PC A05/MF A01. Order Number DE84004167.

Thesis.

Radon and radium concentrations were measured in South Atlantic Bight (SAB) waters during six weeks in the summer of 1981. Sampling was designed to coincide with subsurface intrusions of cold Gulf Stream water onto the continental shelf and was part of a large study of the SAB. The distinct zonation of sediment types within the SAB offered the possibility to use radon to trace advection of intruded bottom water. It was determined that the bottom excess radon concentrations, calculated from radon and radium data, were distributed into three groups. The first group of concentrations ranged from 320 to 732 dpm/100L (n=3) and was associated with water occupying the nearshore zone. The second set was sampled within intruded water in the midshelf region. These values ranged from 25.5 to 151.5 dpm/100L (n=35). The third range describes radon concentrations contained in water that is a potential source of upwelled Gulf Stream water. These shelf break concentrations ranged from -1.0 to 213.0 dpm/100L (n=13), and were found to differ significantly ($P < 0.001$) from the midshelf range of radon concentrations (Mann-Whitney test). The division of radon concentrations into three distinct zones within the SAB waters may provide an indicator of shelf and Gulf Stream water interactions. 55 references, 24 figures, 4 tables.

8553 (INIS-BR—78, pp 70) **Determination of ^{210}Po in Mytilidae.** Santos, P.L. dos; Santos Gouvea, R. de C. dos; Belem, L.J.; Azevedo Gouvea, V. de (Universidade Federal Fluminense, Niteroi (Brazil). Laboratorio de Radiologia e Radiometria). 1982. (In Portuguese). NTIS (US Sales Only), PC A07/MF A01. (CONF-821254—Summ.).

From 7. annual congress of the Brazilian Biophysics Society; Rio de Janeiro, Brazil (15 Dec 1982).

Published in summary form only.

8554 (INIS-BR—78, pp 71) **Iodine biological accumulation by bentonic algae from Angra dos Reis, RJ, Brazil.** Guimaraes, J.R.D.; Franca, E.P. (Rio de Janeiro Univ. (Brazil). Inst. de Biofisica). 1982. (In Portuguese). NTIS (US Sales Only), PC A07/MF A01. (CONF-821254—Summ.).

From 7. annual congress of the Brazilian Biophysics Society; Rio de Janeiro, Brazil (15 Dec 1982).

Published in summary form only.

8555 (INIS-BR—78, pp 66) **Ra-228 and Ra-226 in surface - and ground waters from Morro do Ferro, Pocos de Caldas, MG state, Brazil.** Campos, M.J.; Lobao, N.; Franca, E.P.; Trindade, H. (Rio de Janeiro Univ. (Brazil). Inst. de Biofisica). 1982. (In Portuguese). NTIS (US Sales Only), PC A07/MF A01. (CONF-821254—Summ.).

From 7. annual congress of the Brazilian Biophysics Society; Rio de Janeiro, Brazil (15 Dec 1982).

Published in summary form only.

8556 (INIS-BR—78, pp 68) **Thorium, uranium and rare earths in testimonies of perfurated well in Pocos de Caldas, MG state, Brazil.** Carlos, M.; Pfeiffer, W.C.; Franca, E.P. (Rio de Janeiro Univ. (Brazil). Inst. de Biofisica); Eisenbud, M.; Lei, W. (New York Univ., NY (USA). Medical Center). 1982. (In Portuguese). NTIS (US Sales Only), PC A07/MF A01. (CONF-821254—Summ.).

From 7. annual congress of the Brazilian Biophysics Society; Rio de Janeiro, Brazil (15 Dec 1982).

Published in summary form only.

8557 (INIS-mf—8584, pp 46-48) **Instrumentation for radiochemical water management laboratories.** Pazdernik, J. (Vyzkumny Ustav Vodohospodarsky, Prague (Czechoslovakia)). [nd]. (In Czech). NTIS (US Sales Only), PC A09/MF A01. (CONF-8105231—).

From Conference on nucleonic instruments and their use in the CSSR; Pribram, Czechoslovakia (18 May 1981).

Gross volume alpha and beta activity of surface and drinking water samples is determined by laboratories. Radiochemical separation processes are used with subsequent integral measurement of radiation. Instruments required for the evaluation of such samples are listed.

8558 **(PB—83-243113) Finite element model to predict the flow of underground contaminants due to leakage of chemical and/or radio active material from a buried containment. Final technical report.** Anand, S.C.; Pandit, A. (Clemson Univ., SC (USA). Water Resources Research Inst.). Jun 1983. 277p. (WRRI—107). NTIS, PC A13/MF A01.

In the investigation, a Galerkin finite element model in two dimensions is developed to study the phenomena of mass transfer in porous media. In particular, the problems of the saltwater encroachment in coastal aquifers and the transport of hazardous wastes in groundwater environment are studied for a wide range of aquifer parameters. The coupled governing partial differential equations are nondimensionalized and solved for a two-dimensional, saturated aquifer in the vertical plane for both steady state and transient conditions using an iterative solution procedure. The flow transport is represented either in terms of the stream function or the freahwater hydraulic head.

8559 **(USGS-WSP—2191) Hydrologic conditions at the Idaho National Engineering Laboratory, Idaho - emphasis: 1974-1978.** Barraclough, J.T.; Lewis, B.D.; Jensen, R.G. (Geological Survey, Idaho Falls, ID (USA)). Sep 1982. 58p. USGS, 604 South Pickett St., Alexandria, VA 22304.

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The Idaho National Engineering Laboratory (INEL) site covers about 890 square miles of the eastern Snake River Plain and overlies the Snake River Plain aquifer. Low concentrations of aqueous chemical and radioactive wastes have been discharged to shallow ponds and to shallow or deep wells on the site since 1952. A large body of perched ground water has formed in the basalt underlying the waste disposal ponds in the Test Reactor Area. This perched zone contains tritium, chromium-51, cobalt-60, strontium-90, and several nonradioactive ions. Tritium is the only mappable waste constituent in that portion of the Snake River Plain aquifer directly underlying this perched zone. Low concentrations of chemical and low-level radioactive wastes enter directly into the Snake River Plain aquifer through the Idaho Chemical Processing Plant (ICPP) disposal well. Tritium has been discharged to the well since 1953 and has formed the largest waste plume, about 28 square miles in area, in the regional aquifer, and minute concentrations have migrated downgradient a horizontal distance of 7.5 miles. Other waste plumes south of the ICPP contain sodium, chloride, nitrate, and the resultant specific conductance. These plumes have similar configurations and flow southward; the contaminants are in general laterally dispersed in that portion of the aquifer underlying the INEL. Other waste plumes, containing strontium-90 and iodine-129, cover small areas near their points of discharge because strontium-90 is sorbed from solution as it moves through the aquifer and iodine-129 is discharged in very low quantities. Cesium-137 is also discharged through the well but it is strongly sorbed from solution and has never been detected in a sample of ground water at the INEL.

5204 Thermal Effluents Monitoring And Transport

REFER ALSO TO CITATION(S) 8548

8560 **(AD-A—131736/1) Laser induced damage in the eye: study of energy deposition in the retina. Final report, 1 April 1975-31 March 1976 76.** McGowan, W.J.; Borwein, B.; Medeiros, J.A.; Sanwal, M. (University of Western Ontario, London (Canada)). Jun 1976. 186p. NTIS, PC A09/MF A01.

Considerable research has gone into a study of retinal damage and its repair. However, the major part of this work has dealt with gross damage. By contrast in our program we have tried to develop techniques that allow us to look at the electron microscopic level at damage throughout the entire retina as a function of the frequency of the bombarding radiation (its color) duration of radiation exposure and its intensity. We have also undertaken to examine electron microscopically the morphology of the retina following abuse by either laser light or other electromagnetic radiation in an attempt to understand the repair mechanisms.

8561 **(NP—3770170) Situation report on the effects of the cooling of thermal power plants on waters.** (Eidgenoessisches Amt fuer Energiewirtschaft, Bern (Switzerland)). May 1981. 55p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE83770170.

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All new thermal power plants in the suburbian area of the Rhine and Aare River must be equipped with cooling towers. Mixed cooling is permitted, provided that it is absolutely warranted that the limiting values laid down in the regulation are not trespassed. If the water marks are medium or high an increase of the waste heat output could be permitted. However, the neighbouring states of the Rhine have not yet agreed on this proposal of the Commission for the Protection of the Rhine River.

5205 Site Resource And Use Studies

REFER ALSO TO CITATION(S) 7290, 7574, 8641

8562 **(NE-EO—83-8) Effect of reed harvesting on the water ecology and its flora and fauna of the sea Taakern.** Bengtsson, T.; Ekstam, B.; Landin, J. (Naemnden foer Energiproduktionsforskning, Stockholm (Sweden)). Jan 1983. 132p. (In Swedish). NTIS (US Sales Only), PC A07/MF A01. Order Number DE84750110.

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The effect of harvesting reed during winter has been studied at the sea Taakern in the year 1981. Comparison has been made between harvested and unreaped areas. The following differences were recorded: Wind speed and radiation was increased in springtime. Oxygen supply was enhanced. Lifeless reed was broken down. The structure of the sea bottom was changed. The amount of species in the reaped area was larger than in the unreaped one. The amount of zooplanktons was increased during springtime. There were signs of rapid growth and development in the harvested area.

8563 **(PB—83-249581) Levels of nonpolar organic compounds in the Columbia Generating Station cooling pond. Technical completion report.** Andren, A.W.; Erickson, R. (Wisconsin Univ., Madison (USA). Water Resources Center). 1983. 20p. (WIS/WRC—83-08). NTIS, PC A02/MF A01.

In 1970, plans to build a coal-fired generating station near Portage, Wisconsin and an interest by involved utilities in carrying out a preconstruction analysis of potential environmental changes created a unique opportunity for broadly based research on the impacts of coal-fired steam plants. Of particular concern to aquatic scientists are the potential problems associated with the 192-ha manmade cooling pond. The research presented in this report describes a survey of the types and levels of nonpolar xenobiotic organic compounds in sediments and fish from the cooling pond. Sediment and fish samples were analyzed for PCBs, Sigma DDT, and hexachlorobenzene using techniques developed at the Water Chemistry Laboratory, University of Wisconsin-Madison. It was hypothesized that polyaromatic hydrocarbons and chlorinated hydrocarbons would accumulate; however, results indicate that the microcontaminants do not concentrate in the cooling pond. Reasons for why there is no microcontaminant problem are presented.

53 ENVIRONMENTAL-SOCIAL ASPECTS OF ENERGY TECHNOLOGIES

5301 Social And Economic Studies

8564 **(NP—4770029) Environment and economy.** (Rhein-Ruhr-Stiftung, Essen (Germany, F.R.)). 1982. 10p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84770029.

Economy and ecology have become almost irreconcilable words of tension in our time. They who mismanage the earth will destroy her. They who do not avail themselves of the earth will have mankind reduced to poverty. The common weal and the pros-

perity of the earth entrusted to man require a balance. Man may not become estranged from both, neither from nature, nor from technology. Every one of us has to consider it his ethical obligation to contribute to preserve a largely undisturbed environment for himself and others by imposing restrictions on himself and by doing without the use and consumption of commodities and products.

5302 Assessment Of Energy Technologies

8565 **(ORNL/TM—8672) Exposure assessment methodology and reference environments for synfuel risk analysis.** Travis, C.C.; Baes, C.F. III; Barnthouse, L.W.; Etnier, E.L.; Holton, G.A.; Murphy, B.D.; Thompson, G.P.; Suter, G.W. II; Watson, A.P. (Oak Ridge National Lab., TN (USA)). Dec 1983. Contract W-7405-ENG-26. 89p. NTIS, PC A05/MF A01. Order Number DE84004128.

This document presents an exposure assessment methodology for evaluating health and environmental risk from synfuel technologies. It also provides a broad characterization of the reference environments in which synfuels facilities might be located. The exposure methodologies consider atmospheric, aquatic, and terrestrial food chain pathways. Both short- and long-range atmospheric transport and photochemical transformation methodologies are presented. The aquatic methodology considers surface and ground water transport. The foodchain methodology considers exposure pathways involving drinking water, agricultural produce, beef and milk, and contains a default data base of site-specific agricultural, meteorological, and land use parameters. Characterization of the generic environments is divided into three components: the physical environment, and the ecological and human populations at risk. The methodologies and parameters presented in this report are very generalized, and are intended to be used for screening purposes only. 77 references, 3 figures, 18 tables.

5303 Environmental Impact Statements

8566 **(NP—4900499) Final Environmental Impact Statement: Gulf of Mexico. Proposed OCS oil and gas lease offerings: Central Gulf of Mexico (April, 1984), Western Gulf of Mexico (July, 1984).** (Minerals Management Service, Metairie, LA (USA). Gulf of Mexico OCS Region). Dec 1983. 502p. Minerals Management Service, 3301 N. Causeway Blvd., Metairie, LA 70002.

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The environmental impacts of the proposed action of Central and Western Gulf of Mexico lease offerings are discussed in this Final Environmental Impact Statement. Included are descriptions of the areas concerned, discussions of the alternatives to the proposed action, and environmental consequences of the proposed action and alternatives. (ACR)

55 BIOMEDICAL SCIENCES, BASIC STUDIES

5502 Biochemistry

REFER ALSO TO CITATION(S) 8173, 8574, 8586

8567 (CONF-8205230—Summ., pp 121-123) **Plasminogen activator, DNA repair, and the rapid detection of human cellular responses to DNA damaging agents.** MacInnes, M.; Crawford, B.D. (Los Alamos National Lab., NM). Sep 1983. NTIS, PC A09/MF A01.

From Conference on establishment of a bioassay system for cancer risk assessment in energy technology; Baltimore, MD, USA (3 May 1982).

Urokinase-plasminogen activator (PA) is constitutively expressed at high levels in most virally transformed rodent cells and in some human transformed cells. Hence, measurement of PA induction in vitro has potential utility as part of an integrated, multifaceted, bioassay system designed to detect early events concomitant with human cell transformation and other responses to DNA damage. The appearance of PA is at present a unique enzymatic marker of cellular responses to DNA damage in repair-deficient, adult human fibroblasts. Hence, we propose to test the involvement of PA induction in a general cellular protective response to DNA damage. The major potential advantages of monitoring PA induction are severalfold: (1) ease of measurement; (2) rapidity of the response to inducing agents. Induction of the enzyme in human and rodent cells is relatively rapid (2-days); and (3) general hypersensitivity (for PA induction) of human repair-deficient cells.

8568 **(CONF-8308110—7) Nanosecond time resolved magnetic resonance spectra of P/sup F/ in R. sphaeroides and in R. viridis reaction centers. Orientation of the primary donor in single crystals of R. viridis reaction center.** Wasielewski, M.R.; Gast, P.; Norris, J.R. (Argonne National Lab., IL (USA)). 1983. Contract W-31-109-ENG-38. 4p. NTIS, PC A02/MF A01. Order Number DE84003602.

From 6. international congress on photosynthesis; Brussels, Belgium (1 Aug 1983).

Photoexcitation of the reaction center protein from purple photosynthetic bacteria results in rapid (< 5 ps) formation of a radical pair, P/sup F/ composed of an oxidized bacteriochlorophyll a dimer, P^+ and a reduced bacteriopheophytin a, I^-. The recent crystallization of the reaction center protein from R. viridis enables us to use magnetic resonance to obtain structural information about the reaction center relatively rapidly. We have grown large numbers of R. viridis reaction center crystals and have determined the orientation of the triplet axis system of the primary donor to within + 1 degree as well as a number of magnetically non-equivalent donor sites in the crystal.

8569 **(CONF-8310221—1) Comparison of organisms and cell types using two-dimensional electrophoresis.** Anderson, N.L. (Argonne National Lab., IL (USA)). 1983. Contract W-31-109-ENG-38. 22p. NTIS, PC A02/MF A01. Order Number DE84003574.

From Biology and characterization of cultured vertebrate cell lines symposium; Bethesda, MD, USA (2 Oct 1983).

Various approaches to the use of two-dimensional electrophoretic patterns for the quantitation of protein-taxonomic distances are discussed. In comparisons of closely-related organisms, it is concluded that approximately 1/3 of all single-base substitutions may be detected in approximately 3×10^6 base pairs of coding DNA (assuming 1000 usable spots per pattern). This represents, by far, the highest data rate available in any genomic surveillance technique aimed at measuring single base changes. In comparisons of more distantly-related organisms, current 2-D gels allow exploitation of a range of spot overlap extending from about 2.6% (for completely non-homologous organisms, i.e., spot patterns random with respect to one another) to $\geq$ 90% (for samples from the same organism). Within this range, evolutionary distances characteristic of family, genus, and species differences may be measurable directly in terms of base substitutions per nucleotide averaged over very large amounts of coding DNA. 10 references, 3 figures, 2 tables.

8570 (INIS-BR—78, pp 42) **Role of the activated species of oxygen on the actual breaks of DNA plasmids in E. coli.** Cruz, L.C.L. da; Toledo, S.M. de; Duran, N. (Universidade Estadual de Campinas (Brazil). Inst. de Quimica). 1982. (In Portuguese). NTIS (US Sales Only), PC A07/MF A01. (CONF-821254—Summ.).

From 7. annual congress of the Brazilian Biophysics Society; Rio de Janeiro, Brazil (15 Dec 1982).

Published in summary form only.

8571 (INIS-BR—78, pp 28) **Interactions of potassium ions in the gramicidine channel incorporated to lipid bilayers.** Saraswati, K.; Procopio, J. (Sao Paulo Univ. (Brazil). Inst. de Ciencias Biomedicas). 1982. (In Portuguese). NTIS (US Sales Only), PC A07/MF A01. (CONF-821254—Summ.).

From 7. annual congress of the Brazilian Biophysics Society; Rio de Janeiro, Brazil (15 Dec 1982).

Published in summary form only.

8572 **(LBL—16811) Dynamic and conformational effects of structural perturbations in DNA and RNA studied by nuclear magnetic resonance and chemically induced dynamic nuclear polarization.** Morden, K.M. (Lawrence Berkeley Lab., CA (USA)). Sep 1983. Contract AC03-76SF00098. 285p. NTIS, PC A13/MF A01. Order Number DE84004958.

Thesis.

The conformation and dynamics of oligonucleotides in solution were studied using several different NMR techniques. The oligonucleotides contain a variety of perturbations; (I) an extra cytosine: $dCA_3CA_3G + dCT_8G$, (II) an extra adenine: $d(CGCAGAATTCGCG)_2$, and (III) a G.T mismatch: $d(CGTGAATTCGCG)_2$. These are compared to the unperturbed duplexes, (IV) $dCA_6G + dCT_6G$ and (V) $d(CGCGAATTCGCG)_2$. Through the use of nuclear Overhauser effects; the unpaired cytosine in duplex I was found to be extrahelical. Thermodynamic parameters were determined for duplexes I and IV using UV absorption melting curves. The extrahelical cytosine causes a 15°C decrease in the duplex melting temperature. The standard free energy for duplex formation at 25°C is 2.9 kcal mol^{-1} more positive for the duplex with the extra cytosine. The kinetics for exchange of the imino protons in these oligonucleotide duplexes were studied by saturation recovery techniques. In duplex I, the extra cytosine causes the exchange lifetime for one of the neighboring A.T base pairs to decrease by a factor of two over the other A.T base pairs in the duplex. The extra adenine in duplex II affects the exchange lifetimes throughout the duplex, however, the G.T mismatch in duplex III has a more local effect on the lifetimes. Also presented are solvent accessibility studies of oligonucleotides using Chemically Induced Dynamic Nuclear Polarization (CIDNP). CIDNP was observed for guanine(H8) protons and for guanine(H1') protons in dinucleotides and longer oligonucleoides.

5503 Cytology

8573 **(DOE/EV/70118—T1) Radiation studies on isolated chromosomes. Annual progress report.** (California Univ., Los Angeles (USA)). 1983. Contract AT03-76EV70118. 2p. NTIS, PC A02/MF A01. Order Number DE84004999.

The micronucleus (MN) assay in human lymphocytes can be automated with relative ease. Important new information concerning both the MN and the nuclei can be derived from quantitative analysis of the microscope images. The more immediate impact of this work will come from our development of new methods for staining human lymphocytes, that allows immediate identification of the proliferating cells, and for staining human sperm, that allows immediate identification of the fertile sperm.

5504 Genetics

REFER ALSO TO CITATION(S) 8567

5505 Metabolism

REFER ALSO TO CITATION(S) 8538, 8567

8574 **(DOE/ER/10803—T2) Guard cell biochemistry: response to environmental stimuli causing changes in gas exchange. Progress report.** (Florida State Univ., Tallahassee (USA)). 1983. Contract AS05-81ER10803. 14p. NTIS, PC A02/MF A01. Order Number DE84004910.

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A progress report covering several interrelated studies on the biochemistry and metabolism of leaf guard cells is presented. Subjects covered are: (1) abscisic acid and the control of stomatal aperture size; (2) real-time, direct measurements of NAD(P)H in microdroplets; (3) electron transport through the PSII reaction center in guard cells; (4) organic anion/acid fluctuations as a general phenomena; (5) histological compartmentation of metabolic functions; (6) construction of a gas exchange system; and (7) guard cell protoplast isolation. (DT)

8575 **(INIS-BR—78, pp 101) Differential ontogenesis of D1 and-D2 type dopamine receptors in embryonic retina of chicken.** Ventura, A.L.M.; Mello, F.G. de (Rio de Janeiro Univ. (Brazil). Inst. de Biofisica); Klein, W.L. (Northwestern Univ., Evanston, IL (USA)). 1982. (In Portuguese). NTIS (US Sales Only), PC A07/MF A01. (CONF-821254—Summ.).

From 7. annual congress of the Brazilian Biophysics Society; Rio de Janeiro, Brazil (15 Dec 1982).

Published in summary form only.

5506 Medicine

REFER ALSO TO CITATION(S) 8130, 8203, 8354, 8625

8576 **(DOE/EV/04969—005) Myocardial perfusion scintigraphy using a new technique - the mesh chamber. Progress report, May 1, 1982-November 1, 1983.** Holman, B.L.; Osborne, L.S. (Harvard Medical School, Boston, MA (USA); Massachusetts Inst. of Tech., Cambridge (USA)). 1983. Contract AC02-78EV04969. 23p. NTIS, PC A02/MF A01. Order Number DE84004002.

Work since the last progress report has concentrated in three major areas: development and construction of a multimodule slice type detector system and associated electronics at Massachusetts Institute of Technology (MIT); software development for data acquisition and reconstruction algorithms as implemented on the PDP-11/34 system at Brigham and Women's Hospital (BWH); testing of a system of 10 cm x 10 cm area cameras at BWH. The software development includes a method which we believe represents a unique approach to reconstruction of images. We report on this work in more detail in subsequent sections of this report.

8577 **(INIS-BR—78, pp 64) Scintillographic evaluation of liquor circulation by sup(99m)Tc-DTPA.** Penas, M.E.; Maliska, C.; Goncalves, M.R.B.; Costa, A.J.; Pinto, J.C.M. (Rio de Janeiro Univ. (Brazil). Hospital Universitario). 1982. (In Portuguese). NTIS (US Sales Only), PC A07/MF A01. (CONF-821254—Summ.).

From 7. annual congress of the Brazilian Biophysics Society; Rio de Janeiro, Brazil (15 Dec 1982).

Published in summary form only.

8578 **(INIS-mf—8218) Alterations and diseases of the gastrointestinal tract caused by old age. Case descriptions and literature review of X-ray diagnostics in old age.** Bayerl, F. (Wuerzburg Univ. (Germany, F.R.). Medizinische Fakultaet). 4 Nov 1981. 55p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE83703950.

The dissertation reviews the publications on 'The gastrointestinal tract in old age' since 1941. As in the 1941 publication by Heinrich, particular interest is taken in diagnostic radiology. The lower age limit of the cases described was set at 55 to 60 years. Oesophageal changes ranged from functional disturbances (e.g. atonia, changes in peristalsis, or dilatation) to chronic inflammation, displacement caused by the surrounding organs, and tumours (mainly carcinoma). Formation of diverticula takes an intermediate position. Of the gastric and duodenal changes, hiatal hermia and chronic atrophic gastritis were the most frequent. Ulcers caused by old age differ from 'common' ulcers in some respects, and the symptoms may be confused with those of gastric carcinoma. Early gastric carcinoma is another disease whose incidence increases with age. Thoracic and spinal changes may cause impressions on the stomach. The effects of old age on the time of passage of contrast media, on gastric tone, and on the shape of the stomach remain unclear. Changes caused by old age in the small and large intestine range from formation of diverticula and vascular diseases (e.g. ischaemic colitis and obstruction of the mesenteric vessels) to the frequent carcinoma of the large intestine and rectum. According to this study it has to be supposed that the degenerative atrophic processes of aging and previous diseases occurring increasingly in old age, favour the provocation of ratrogenic injuries.

8579 **(INIS-mf—8219) Cardiac chamber scintiscanning. 1. Comparison of the examination methods. 2. Comparative evaluations of 5 different analytic procedures for ECG-triggered studies.** Goretzki, G. (Freie Univ. Berlin (Germany, F.R.). Fachbereich Humanmedizin). 17 Nov 1981. 125p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE83703953.

The two methods of cardiac chamber scintiscanning, i.e. 'first pass' and 'ECG-triggered' examinations, are explained and compared. Two tables indicate the most significant radiation doses of the applied radio tracers, i.e. 99m-Tc-pertechnetate and 99m-Tc-HSA, to which a patient is exposed. These averaged values are calculated from various data given in specialised literature. On the basis of data given in literature, an effective half-life of approximately 5 hours in the intravascular space was calculated for the erythrocytes labelled with technetium 99m. On this basis, the radiation doses for the patients due to 99m-Tc-labelled erythrocytes are estimated. The advantages and disadvantages of the two methods applied for cardiac chamber scintiscanning are put into contrast and compared with the advantages and disadvantages of the quantitative X-ray cardiography of the left heart. The still existing problems connected with the assessment of ECG-triggered images are discussed in detail. The author performed investigations of his own, which concerned the above-mentioned problems.

8580 **(INIS-mf—8220) Clinical and radiological follow-up examinations following fractures of the Collum mandibulae.** Guss, K. (Freie Univ. Berlin (Germany, F.R.). Fachbereich Zahn-, Mund- und Kieferheilkunde). 5 Oct 1981. 66p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE83703951.

All patients presented a fracture of the collum mandibulae, which had occurred between 1 and 10 years before treatment. The patients were exclusively treated conservatively. 57 of 67 patients did not indicate any subjective pain. 10 patients complained about pain and restricted mobility. In only 22 cases no pathologic findings were obtained in the clinical follow-up examinations. In 33 patients the roentgenologic follow-up examination led to pathologic findings. Severe complications as disturbance of growth and formation of ankyloses, occurred only in one single case, due to a fracture of the mandibular joint in childhood.

8581 **(INIS-mf—8238) Computed tomographic findings in natal encephalopathies and their significance for the prognosis for the near future and long-term development.** Kotlarek, F. (Technische Hochschule Aachen (Germany, F.R.). Medizinische Fakultaet). 1 Jun 1981. 151p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE83703952.

190 premature babies and newborn with a hypoxic or traumatic natal encephalopathy were examined in the newborn period with cranial computed tomography. 10 other neonatals with cyanotic vitia even without neurologic syndromes were included into this study. 73 of these infants were incubated for a while and supplied with air. The CT findings were compared with those of a "control group" of neonatals who provided externally visible malformations but no burdening perinatal anamnesis. 82 premature and neonatal babies showed abnormal morphologic basic findings. Due to kind, localisation and size of the lesion, different morphologic patterns - depending on the birth weight - can be delineated.

8582 (INIS-mf—8536, pp 65-66) **Preparation of hepatic agents derived from the iminodiacetic acid for the labelled with technetium 99.** Fucugauchi de S, M.E.; Lezama C, J. (Instituto Nacional de Investigaciones Nucleares, Mexico City). 1982. (In Spanish). NTIS (US Sales Only), PC A05/MF A01. (CONF-820958—Summ.).

From 4. symposium on nuclear chemistry, radiochemistry and radiation chemistry; Mexico City, Mexico (7 Sep 1982).

Published in summary form only.

8583 (INIS-mf—8536, pp 67-68) **Preparation of microspheres for the study of the pulmonary perfusion.** Garcia H., G.; Espejel M., B. (Instituto Nacional de Investigaciones Nucleares, Mexico City). 1982. (In Spanish). NTIS (US Sales Only), PC A05/MF A01. (CONF-820958—Summ.).

From 4. symposium on nuclear chemistry, radiochemistry and radiation chemistry; Mexico City, Mexico (7 Sep 1982).

Published in summary form only.

8584 (INIS-mf—8584, pp 81-82) **RIA cassette meter.** Lozek, P. (Ceskoslovenska Komise pro Atomovou Energii, Prague); Prochazka, H.; Veit, M. (Vyzkumny Ustav Veterinarniho Lekarstvi, Brno-Medlanky (Czechoslovakia)). [nd]. (In Czech). NTIS (US Sales Only), PC A09/MF A01. (CONF-8105231—).

From Conference on nucleonic instruments and their use in the CSSR; Pribram, Czechoslovakia (18 May 1981).

Published in summary form only.

8585 (INIS-mf—8584, pp 191-197) **Nuclear medicine instrument system.** Broj, K.; Javornicky, K.; Dvorak, V.; Hajek, J. (Tesla, Premysleni (Czechoslovakia). Vyzkumny Ustav Pristroju Jaderne Techniky). [nd]. (In Czech). NTIS (US Sales Only), PC A09/MF A01. (CONF-8105231—).

From Conference on nucleonic instruments and their use in the CSSR; Pribram, Czechoslovakia (18 May 1981).

The system consists of three basic parts, viz., a rack with two directional detection units and selectable types of collimator, a two-channel spectrometer designed for medical purposes and a remote-controlled recorder. The system can be used for measuring an isotope mixture in two energy ranges with the possibility of separate adjustment of the discrimination levels of the two amplitude discriminators. It also allows successive subtraction of pulse rates in the first and the second channels and displays their sum. The instrument can be used for differential, wide-channel and integral evaluation. The specifications of the system are presented.

8586 **(LA-UR—83-3423) Digital filtering in a disease detection system.** Brown, R.R. (Los Alamos National Lab., NM (USA)). 1983. Contract W-7405-ENG-36. 15p. (CONF-831254—2). NTIS, PC A02/MF A01. Order Number DE84003820.

From Agricultural electronics - 1983 and beyond conference; Chicago, IL, USA (11 Dec 1983).

A low-pass, nonrecursive digital filter has been designed to process data in an automated enzyme immunoassay system. The software implemented filter has been installed in the Intel 80/10 system controller. A low-speed sample rate of three samples per second allowed the filter algorithm to be programmed in the high-level FORTRAN language with a resultant execution speed of 0.6 seconds per day array. Fourier techniques are used to derive a zero phase shift filter algorithm from a frequency domain prototype. The resulting alogrithm is modified by a Hamming window to reduce transients and Gibbs phenomenon oscillations. Observations on the effectiveness of the filter under full system operation indicate a 90% data recovery rate.

8587 **(PB—83-251041) Diagnostic enteral gastrointestinal radiopaque human prescription drugs class labeling guideline for professional labeling. Final report.** Chun, M.Y. (National Center for Drugs and Biologics, Rockville, MD (USA)). 21 Sep 1982. 8p. NTIS, PC A02/MF A01.

The Food and Drug Administration (FDA) announces the availability of a class labeling guideline for the professional labeling of diagnostic enteral gastrointestinal radiopaque agents. Class labeling is appropriate for these products because they are all closely related in chemical structure, pharmacology, therapeutic activity, and adverse reactions. The guideline is intended to promote the use of identical professional labeling for each member of the diagnostic enteral gastrointestinal radiopaque drug class.

8588 **Therapeutic applications of Auger and alpha emitting radionuclides.** Bloomer, W.D.; McLaughlin, W.H.; Adelstein, S.J. (Harvard Medical School, Boston, MA (USA)); Wolf, A.P. (Chemistry Department, Brookhaven National Laboratory, Upton, NY (USA)). pp 147-150 of Nuclear medicine and biology. Proceedings Vol. 1. Raynaud, C. (ed.). Paris, France; Pergamon (1982). (CONF-820804—Vol.1).

From 3. world congress of nuclear medicine and biology; Paris, France (29 Aug 1982).

Several therapeutic strategies were devised in model systems to demonstrate that Auger (e.g., ^{125}I) and alpha emitting (e.g. ^{211}At) radionuclides, when affixed to appropriate carriers, hold great promise for selectively destroying tumor cell populations. Auger emitters must be localized within the genome to manifest maximal toxicity. Such localization requirements are less precise but no less exacting for alpha emitters where the mean path length is several cell diameters. Further development of therapeutic radiopharmaceuticals will require the concentrated efforts of chemist and biologist to identify selectively localized carriers and design labeled compounds that retain biological specificity.

8589 **In vivo stable isotope labelling with ^{13}C.** Krumbiegel, P. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung). pp 113-114 of 18. symposium of the Sektion Nuklearmedizin der Gesellschaft fuer Medizinische Radiologie der DDR. Proceedings. Berlin, Germany, DDR; Tsocommerz G.m.b.H (1982). (In German)(CONF-811291—).

From 18. symposium on nuclear medicine; Reinhardsbrunn, German D.R. (7 Dec 1981).

8590 **18. symposium of the Sektion Nuklearmedizin der Gesellschaft fuer Medizinische Radiologie der DDR. Proceedings.** Berlin, Germany; Isocommerz G.m.b.H. (1982). vp. (CONF-811291—).

From 18. symposium on nuclear medicine; Reinhardsbrunn, German D.R. (7 Dec 1981).

Selected papers were processed for inclusion in the Energy Data Base.

8591 **Reliability of the radiological determination of cardiac volume for early diagnosis of cardiac insufficiency.** Sulieman, Z.A. Heidelberg, Germany, F.R.; Heidelberg Universitaet (1980). 31p. (In German). Library of Heidelberg Univ. (Germany, F.R.).

In the present study the limits of the normal roentgenologic cardiac volume are thoroughly discussed. According to these limits and to the normal echocardiographic dimensions of the left ventricle - all parameters referred to the body surface - three patient groups result by comparison: 1. The X-ray image presents normal cardiac volumes, but sonographically the left ventricle appears enlarged. 2. The second group of 7 patients showed an enlargement of the roentgenologically determined cardiac volume, whereas the left ventricle appeared normal in echocardiography. 3. In 16 patients with normal cardiac function and in 9 patients with an unequivocally enlarged heart the results of both methods agreed. The radiologic determination of the cardiac volume referred to the body surface and the echocardiographic measurement of the left ventricle are two methods, whose informative values complete each other and which thus permit to reliably assess the cardiac function and to take therapeutic measures. Accordingly these methods do not exclude one another.

5507 Microbiology

REFER ALSO TO CITATION(S) 8467, 8570, 8614

5530 Agriculture And Food Technology

8592 (INIS-mf—8536, pp 78) **Elaboration, sterilization and biological proofs of an animal's food.** Guasti de F., M.V. (Universidad Nacional Autonoma de Mexico, Mexico City. Centro de Estudios Nucleares); Olguin R., F. (Universidad Nacional Autonoma de Mexico, Mexico City). 1982. (In Spanish). NTIS (US Sales Only), PC A05/MF A01. (CONF-820958—Summ.).

From 4. symposium on nuclear chemistry, radiochemistry and radiation chemistry; Mexico City, Mexico (7 Sep 1982).

Published in summary form only.

8593 (INIS-mf—8536, pp 79) **Treatment of chicken meat using gamma radiation of Co-60 in low doses and refrigeration.** Luna C., P.; Bustos, M.E.; Ramirez, T. (Instituto Nacional de Investigaciones Nucleares, Mexico City). 1982. (In Spanish). NTIS (US Sales Only), PC A05/MF A01. (CONF-820958—Summ.).

From 4. symposium on nuclear chemistry, radiochemistry and radiation chemistry; Mexico City, Mexico (7 Sep 1982).

Published in summary form only.

8594 **(ORNL/TM—8805) Whole-tree harvesting: Fourth year progress report for 1982 - nutrient depletion estimates, postharvest impacts on nutrient dynamics, and regeneration.** West, D.C.; Mann, L.K. (Oak Ridge National Lab., TN (USA)). Dec 1983. Contract W-7405-ENG-26. 105p. NTIS, PC A06/MF A01. Order Number DE84003372.

The environmental effects of residue removal and whole-tree utilization for several forest types in the United States are being studied. Sites were selected to include central hardwoods, northern hardwoods, northern hardwood, northern coniferous, southern Appalachian oak-hickory, northwestern coniferous, and southern pine forests. All sites have been established at locations having a long history of biomass and nutrient cycling research to provide a foundation of data to assess the effects of whole-tree harvest on erosion, nutrients, water quality, and productivity. This report (the fourth in a series) describes the direct effects of intensive harvesting and some regeneration effects. Harvesting, including bole only and residue removal, is complete at all sites, and ecosystem nutrient budgets for most sites are presented. Short-term direct effects on nutrients cycling processes, impacts of different intensities of harvest on nutrient pools, and uncertainties of long-term effects are discussed. A brief discussion of implications of whole-tree removal is included. 12 references, 9 figures, 43 tables.

56 BIOMEDICAL SCIENCES, APPLIED STUDIES

5601 Radiation Effects

REFER ALSO TO CITATION(S) 7308, 7308, 8293, 8553, 8554, 8573

8595 **(AD-A—131847/6) Combined effects of ionizing radiation and anticholinesterase exposure on rodent motor performance. Final report Oct 82-Jan 83.** Wheeler, T.G.; Cordts, R.E. (School of Aerospace Medicine, Brooks AFB, TX (USA)). Jul 1983. 16p. (SAM-TR—83-30). NTIS, PC A02/MF A01.

Ionizing radiation and anticholinesterase exposure produce a performance decrement. The objective of this study was to determine if combined exposure would produce a greater deficit than either insult present alone. Five behavioral measures were taken on four experimental test groups. The test groups consisted of: (1) sham controls, (2) radiation exposure only (7 Gy), (3) physostigmine exposure only (0.1 mg/kg), and (4) radiation-plus physostigimine exposure. The behavioral measures were: (1) ability to maintain balance on a rotating rod, and (2) four measures of general motor activity in an activity monitor--crossing, rearings, groomings, and boli excreted. Animals were evaluated on the behavioral test battery three times postirradiation (45 min, 4 days, and 8 days). The radiation-only test group had a 30% performance deficit at 45 min postirradiation which decreased to a 60% deficit by Day 8. The physostigimine test group had a 40% deficit for each of the periods. The combined treatment groups showed a 60% performance deficit on each of the tests periods. All measures of performance indicated that the combined exposure to ionizing radiation and physostigmine was much greater than either insult alone. The extent of the performance deficit was task dependent and appears to be a nonlinear function. The underlying mechanisms are not yet known.

8596 **(BNL—33795) ^{20}neon ion- and x-ray-induced mammary carcinogenesis in female rats.** Shellabarger, C.J.; Baum, J.W.; Holtzman, S.; Stone, J.P. (Brookhaven National Lab., Upton, NY (USA)). 1983. Contract AC02-76CH00016. 13p. (CONF-8310231—3). NTIS, PC A02/MF A01. Order Number DE84002881.

From International conference on hematopoietic cellular proliferation; Upton, NY, USA (6 Oct 1983).

One of the proposed uses of heavy ion irradiation is to image lesions of the human female breast. The rat model system was chosen to assess the carcinogenic potential of heavy ion irradiation in the belief that data obtained from rat studies would have a qualitatively predictive value for the human female. Accordingly, female rats were exposed to ^{20}Ne ions at the BEVALAC and studied for the development of mammary neoplasia for 312 +- 2 days at Brookhaven along with rats exposed concurrently to x-irradiation or to no irradiation. As the dose of either type of radiation was increased the percent of rats with mammary adenocarcinomas, and the percent of rats with mammary fibroadenomas, tended to increase. At a prevalence of 20%, the RBE for ^{20}Neon ions for mammary adenocarcinomas was estimated to be larger than 5 and for mammary fibroadenomas the RBE was estimated to be less than 2. No conclusion was reached concerning whether or not the RBE might vary with dose. We suggest that ^{20}Ne ions do have a carcinogenic potential for rat mammary tissue and that this carcinogenic potential is likely to be greater than for x-irradiation. (DT)

8597 **(CONF-830710—13) Repair mechanisms in radiation-induced cell transformation.** Elkind, M.M.; Han, A.; Hill, C.K.; Buonaguro, F. (Argonne National Lab., IL (USA); Colorado State Univ., Fort Collins (USA). Dept. of Radiology and Radiation Biology; Naples Univ. (Italy). Ist. di Patologia Generale). 1983. Contract W-31-109-ENG-38. 11p. NTIS, PC A02/MF A01. Order Number DE84004040.

From 7. international conference of radiation research; Amsterdam, Netherlands (3 Jul 1983).

Our data with both low- and high-LET radiations are qualitatively similar to results obtained in vivo. This is evident, for example, in the reductions in cell transformation for protracted exposures of γ-rays. The consistencies between our results with cells and the data of others with animals lend support to Gray's hypothesis that tumorigenesis is the net effect of a low probability inductive process, and a high probability killing process. An important prediction can be made when spontaneous frequency is appreciable (e.g., 43% in the case of reticulum cell sarcoma in RFM mice). For small doses, tumorigenesis would drop provided that: (a) the cells responsible for the spontaneous incidence are present at the time of exposure; and (b) the progenitor cells of the tumor are not resistant to cell killing.

8598 **(CONF-840202—2) Exposure management in a hot-cell decontamination and refurbishment campaign.** Courtney, J.C.; Ferguson, K.R.; Chesnovar, D.L.; Huebner, M.F. (Louisiana State Univ., Baton Rouge (USA). Nuclear Science Center; Argonne National Lab., Idaho Falls, ID (USA)). 1984. Contract W-31-109-ENG-38. 22p. NTIS, PC A02/MF A01. Order Number DE84003590.

From 17. midyear topical meeting of the Health Physics Society; Pasco, WA, USA (5 Feb 1984).

We developed a minicomputer-based system to provide rapid access to personnel dosimetry data during a campaign to decontaminate and refurbish a hot-cell at the Hot Fuel Examination Facility (HFEF) Complex. This system allows project management to estimate doses for future tasks, assess the effectiveness of decontamination and personnel protection techniques, and balance exposures among members of various skill groups. As the campaign progresses, projected total exposures can be minimized by tradeoffs between estimated doses during decontamination and estimated dose savings during the refurbishment phase. The effectiveness of various dose-reduction procedures can be compared on the basis of data from a few cell entries before more extensive routine operations are scheduled. Because the radiation fields vary significantly with location in the cell, we find that measurements of whole-body, skin, and extremity doses are more valuable than dose-rate information. Penetrating and skin radiation doses to personnel can be compared to administrative guidelines. This helps us to select the most effective combination of protective clothing. For example, leaded gauntlets reduce the dose rate to the workers' hands, but their use can increase the time required for some in-cell tasks. Hence, use of gauntlets can lead to higher whole-body and skin doses. The program is written for the HFEF Complex Harris/6 minimainframe computer with a disk-monitor operating system.

8599 **(IAEA-TECDOC—289) Chimerism in irradiated dicotyledonous plants. Report of a consultants' meeting organized by the Joint FAO/IAEA Division of Isotope and Radiation Applications of Atomic Energy for Food and Agricultural Development held in Vienna, 30 November - 4 December 1981.** (Joint FAO/IAEA Div. of Isotope and Radiation Applications of Atomic Energy for Food and Agricultural Development, Vienna (Austria)). Jun 1983. 65p. (CONF-8111183—). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84780053.

From Meeting on chimerism in irradiated dicotyledonous plants; Vienna, Austria (30 Nov 1981).

Items within the scope of EDB have been entered individually into the data base. (ACR)

8600 (INIS-BR—78, pp 43) **SOS functions in S. epidermidis: W-reactivation-and W-mutagenesis study.** Silva, B.S.; Leitao, A.C. (Rio de Janeiro Univ. (Brazil). Inst. de Biofisica). 1982. (In Portuguese). NTIS (US Sales Only), PC A07/MF A01. (CONF-821254—Summ.).

From 7. annual congress of the Brazilian Biophysics Society; Rio de Janeiro, Brazil (15 Dec 1982).

Published in summary form only.

8601 (INIS-BR—78, pp 44) **Oxygen dependent lethal injuries caused by monochromatic UVB radiation (313 nm).** Miguel, A.G. (Institut Suisse de Recherches Experimentales sur le Cancer, Lausanne); Tyrrell, R.M. (Rio de Janeiro Univ. (Brazil). Inst. de Biofisica). 1982. (In Portuguese). NTIS (US Sales Only), PC A07/MF A01. (CONF-821254—Summ.).

From 7. annual congress of the Brazilian Biophysics Society; Rio de Janeiro, Brazil (15 Dec 1982).

Published in summary form only.

8602 (INIS-BR—78, pp 45) **Mutagenic interaction between long ultraviolet radiation and DNA injurious treatment in E. coli: Participation of the growth delay induced by the long ultraviolet radiation.** Moraes, E.C. de; Tyrrell, R.M. (Rio de Janeiro Univ. (Brazil). Inst. de Biofisica). 1982. (In Portuguese). NTIS (US Sales Only), PC A07/MF A01. (CONF-821254—Summ.).

From 7. annual congress of the Brazilian Biophysics Society; Rio de Janeiro, Brazil (15 Dec 1982).

Published in summary form only.

8603 (INIS-BR—78, pp 48) **Electrokinetic responses of Tritrichomonas foetus to near and far-UV radiation.** Costa e Silva Filho, F.; Elias, C.A.; Souza, W. de (Rio de Janeiro Univ. (Brazil). Inst. de Biofisica). 1982. NTIS (US Sales Only), PC A07/MF A01. (CONF-821254—Summ.).

From 7. annual congress of the Brazilian Biophysics Society; Rio de Janeiro, Brazil (15 Dec 1982).

Published in summary form only.

8604 (INIS-BR—78, pp 50) **Determination of the radiosensibility of the 256 Walker tumor.** Sakate, M.; Sakate, A.T.Y. (UNESP, Botucatu (Brazil). Faculdade de Medicina). 1982. (In Portuguese). NTIS (US Sales Only), PC A07/MF A01. (CONF-821254—Summ.).

From 7. annual congress of the Brazilian Biophysics Society; Rio de Janeiro, Brazil (15 Dec 1982).

Published in summary form only.

8605 (INIS-BR—78, pp 51) **Study on the fractionated dose of ionizing radiation on the 256 Walker tumor in rats.** Sakate, A.T.Y. (UNESP, Botucatu (Brazil). Faculdade de Medicina). 1982. (In Portuguese). NTIS (US Sales Only), PC A07/MF A01. (CONF-821254—Summ.).

From 7. annual congress of the Brazilian Biophysics Society; Rio de Janeiro, Brazil (15 Dec 1982).
Published in summary form only.

8606 (INIS-BR—78, pp 84) **^{86}Rb and ^{45}Ca flux alterations in the insulin secretion inhibition caused by adrenaline.** Carpinelli, A.R.; Mathias, P.C.; Sannomiya, P.; Pupo, A.A.; Rocha, M.S.; Salvato, E.M. (Sao Paulo Univ. (Brazil). Inst. de Ciencias Biomedicas). 1982. (In Portuguese). NTIS (US Sales Only), PC A07/MF A01. (CONF-821254—Summ.).
From 7. annual congress of the Brazilian Biophysics Society; Rio de Janeiro, Brazil (15 Dec 1982).
Published in summary form only.

8607 (INIS-BR—78, pp 23) **Half-life of iodine^{125} - labelled fibrinogen in normal guinea pigs.** Almeida, M.R.H. de; Abreu Maffei, F.H. de (UNESP, Botucatu (Brazil). Inst. Basico de Biologia Medica e Agricola). 1982. (In Portuguese). NTIS (US Sales Only), PC A07/MF A01. (CONF-821254—Summ.).
From 7. annual congress of the Brazilian Biophysics Society; Rio de Janeiro, Brazil (15 Dec 1982).
Published in summary form only.

8608 (INIS-BR—78, pp 65) **Scintillographic evaluation of the portal circulation in rabbits submitted to selective linking of the portal trunks.** Maliska, C.; Rosenthal, D. (Rio de Janeiro Univ. (Brazil). Hospital Universitario; Rio de Janeiro Univ. (Brazil). Inst. de Biofisica). 1982. (In Portuguese). NTIS (US Sales Only), PC A07/MF A01. (CONF-821254—Summ.).
From 7. annual congress of the Brazilian Biophysics Society; Rio de Janeiro, Brazil (15 Dec 1982).
Published in summary form only.

8609 (INIS-BR—78, pp 85) **^{86}Ru and ^{45}Ca flux in the insulin secretion stimulated by acetylcholine.** Mathias, P.C.; Salvato, E.M.; Pupo, A.A.; Boschero, A.C.; Carpinelli, A.R. (Sao Paulo Univ. (Brazil). Inst. de Ciencias Biomedicas). 1982. (In Portuguese). NTIS (US Sales Only), PC A07/MF A01. (CONF-821254—Summ.).
From 7. annual congress of the Brazilian Biophysics Society; Rio de Janeiro, Brazil (15 Dec 1982).
Published in summary form only.

8610 (INIS-BR—78, pp 86) **Cellular Li+ opens paracellular path in toad skins: an amiloride blockable effect.** Aboulafia, J.; Sanioto, S.M.L.; Lacaz-Vieira, F. (Sao Paulo Univ. (Brazil). Inst. de Ciencias Biomedicas). 1982. NTIS (US Sales Only), PC A07/MF A01. (CONF-821254—Summ.).
From 7. annual congress of the Brazilian Biophysics Society; Rio de Janeiro, Brazil (15 Dec 1982).
Published in summary form only.

8611 (INIS-BR—78, pp 93) **Phosphate incorporation in vitelline and vitellogenin of Rhodnius Prolixus.** Matsuda, H.; Oliveira, P.L. de (Rio de Janeiro Univ. (Brazil). Inst. de Ciencias Biologicas). 1982. (In Portuguese). NTIS (US Sales Only), PC A07/MF A01. (CONF-821254—Summ.).
From 7. annual congress of the Brazilian Biophysics Society; Rio de Janeiro, Brazil (15 Dec 1982).
Published in summary form only.

8612 (INIS-mf—8585, pp S59) **Repair of UV-radiation induced lethal damage in phage SPP1 by host cell in the presence of dark repair inhibitors.** Janovska, E.; Vizdalova, M. (Ceskoslovenska Akademie Ved, Brno. Biofysikalni Ustav); Zhestyanikov, V.D. (AN SSSR, Leningrad. Inst. Tsitologii). [nd]. NTIS (US Sales Only), PC A02/MF A01. (CONF-8010347—Absts.).
From 15. annual meeting of the Czechoslovak Society for Microbiology; Gottwaldov, Czechoslovakia (7 Oct 1980).
Published in summary form only.

8613 (INIS-mf—8585, pp S59-S60) **Repair of lethal damage of phage DNA induced by ionizing radiation and alkylating agents.** Vizdalova, M.; Janovska, E. (Ceskoslovenska Akademie Ved, Brno. Biofysikalni Ustav); Zhestyanikov, V.D. (AN SSSR, Leningrad. Inst. Tsitologii). [nd]. NTIS (US Sales Only), PC A02/MF A01. (CONF-8010347—Absts.).
From 15. annual meeting of the Czechoslovak Society for Microbiology; Gottwaldov, Czechoslovakia (7 Oct 1980).
Published in summary form only.

8614 **(INIS-mf—8585) Fifteenth annual meeting of the Czechoslovak Society for Microbiology. Abstract of communications.** (Ceskoslovenska Lekarska Spolecnost J.E. Purkyne, Prague. Ceskoslovenska Spolecnost pro Mikrobiologii a Epidemiologii). [nd]. 4p. (CONF-8010347—Absts.). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84780045.
From 15. annual meeting of the Czechoslovak Society for Microbiology; Gottwaldov, Czechoslovakia (7 Oct 1980).
Items within the scope of EDB have been entered individually into the data base. (ACR)

8615 **(LBL—14772-Rev.) Carcinogenesis and low-level ionizing radiation with special reference to lung cancer and exposure to radon daughters.** Fabrikant, J.I. (Lawrence Berkeley Lab., CA (USA); California Univ., San Francisco (USA). Dept. of Radiology). Jun 1982. Contract AC03-76SF00098. 51p. (CONF-820640—2-Rev.). NTIS, PC A04/MF A01. Order Number DE84004238.
From IEEE Computer Society conference; Las Vegas, NV, USA (14 Jun 1982).
The quantitative estimation of the carcinogenic risk of low-dose, high-LET radiation in the case of exposure to radon daughters and lung-cancer is subject to numerous uncertainties. The greatest of these concerns the parametric values of the dose-response curve. We lack knowledge and an understanding of the dosimetry and the distribution of aggregates of radioactivity that remain localized as hot spots in specific regions of the lungs and the influence on greater or lesser risk of lung cancer per average lung dose than uniformly deposited radiation (NRC76). We have only a limited understanding of the response to exposure to high-LET radiations, such as alpha particles, for which linear risk estimates for low doses are less likely to overestimate the risk, and may, in fact, underestimate the risk (BEIR80). Other uncertainties include the length of the latency period, the RBE for alpha radiation relative to gamma radiation, the period during which the radiation risk is expressed, the risk projection model used - whether absolute or relative - for projecting risk beyond the period of observation, the effect of dose rate and protraction of dose, and the influence of differences in the natural incidence of lung cancer in different populations. In addition, uncertainties are introduced by the biological and life-style risk characteristics of humans, for example, the effect of sex, the effect of age at the time of irradiation and at the time of appearance of the cancer, the influence of length of observation or follow-up of the study populations, and the influence of perhaps the most important confounding bias, cigarette-smoking. The collective influence of these uncertainties is such as to deny great credibility to any estimate of human lung cancer risk and other cancer risk that can be made for low-dose, high-LET radon daughter radiation exposure.

8616 **(PNL-SA—11571) Influence of random daughter exposure rate, unattachment fraction, and disequilibrium on occurrence of lung tumors.** Cross, F.T.; Palmer, R.F.; Dagle, G.E.; Busch, R.H.; Buschbom, R.L. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1983. Contract AC06-76RL01830. 14p. (CONF-831049—2). NTIS, PC A02/MF A01. Order Number DE84003957.
From International seminar on indoor exposure to natural radiation and related risk assessment; Capri, Italy (3 Oct 1983).
Groups of male, specific-pathogen-free (SPF), Wistar rats were exposed to several concentrations of radon daughters and uranium ore dust to clarify the roles of exposure rate, unattached RaA daughters, and the degree of radon daughter disequilibrium, in the development of respiratory system disease. Modeled, human-dosi-

metric data indicate that the dose to sensitive tissues of the respiratory tract increases with increasing radon-daughter unattachment fraction and degree of disequilibrium. Experimental verification of these dose-effect relationships is needed to protect the health of workers and of the public exposed to radon-daughter environments. Data bearing on these relationships as well as updated results of experiments designed to test the role of radon-daughter exposure rate on lung-tumor incidence are reported. 13 references, 3 tables.

8617 **XXII. Congress of radiologists. Abstracts.** Karl-Marx-Stadt, Germany; Gesellschaft fuer Medizinische Radiologie der DDR (1982). vp. (CONF-8210198—Absts.).

From 22. congress of radiologists of the GDR; Karl-Marx-Stadt, German D.R. (25 Oct 1982).

Separate abstracts have been prepared for individual items within the scope of the Energy Data Base.

8618 **Superoxide toxic and superixide dismutases.** Fee, J.A. pp 236-239 of Oxygen and oxy-radicals in chemistry and biology. Rodgers, M.A.J.; Powers, E.L. (eds.). New York, NY; Academic Press (1981).

There is evidence for O_2^- toxicity and for the protective role of SOD but there are also serious data which show that the mechanism and the interpretation and even the toxicity of O_2^- may be wrong.

8619 **Influence of 5-thio-D-glucose and gamma radiation on the DNA synthesis of L5178Y cells.** Magdon, E.; Schroeder, E. (Akademie der Wissenschaften der DDR, Berlin. Zentralinstitut fuer Krebsforschung). pp vp of XXII. Congress of Radiologists. Abstracts. Berlin, German, DDR; Gesellschaft fuer Medizinische Radiologie ([nd]). (In German)(CONF-8210198—Absts.).

From 22. congress of radiologists of the GDR; Karl-Marx-Stadt, German D.R. (25 Oct 1982).

8620 **Studies on the clinical application of 4-nitroimidazole as radiosensitizer.** Magdon, E.; Schroeder, E. (Akademie der Wissenschaften der DDR, Berlin. Zentralinstitut fuer Krebsforschung). pp vp of XXII. Congress of Radiologists. Abstracts. Berlin, German, DDR; Gesellschaft fuer Medizinische Radiologie ([nd]). (In German)(CONF-8210198—Absts.).

From 22. congress of radiologists of the GDR; Karl-Marx-Stadt, German D.R. (25 Oct 1982).

8621 **Dose-time relationship of radiogenic pneumopathy. Model experiments with store pigs and their clinical relevance.** Herrmann, T.; Voigtmann, L.; Knorr, A.; Lorenz, J. (Medizinische Akademie, Dresden (German Democratic Republic). Radiologische Klinik). pp vp of XXII. Congress of Radiologists. Abstracts. Berlin, German, DDR; Gesellschaft fuer Medizinische Radiologie ([nd]). (In German)(CONF-8210198—Absts.).

From 22. congress of radiologists of the GDR; Karl-Marx-Stadt, German D.R. (25 Oct 1982).

8622 **Lithium carbonate as modificator of leukocytic depression in whole-body irradiated rats.** Rose, H.; Kehrberg, G.; Saul, G.; Pradel, I. (Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite)). pp vp of XXII. Congress of Radiologists. Abstracts. Berlin, German, DDR; Gesellschaft fuer Medizinische Radiologie ([nd]). (In German)(CONF-8210198—Absts.).

From 22. congress of radiologists of the GDR; Karl-Marx-Stadt, German D.R. (25 Oct 1982).

8623 **Skin lesions in miniature pigs following local irradiation with 250 kV X-rays and 6.2 MeV neutron, respectively.** Winterfeld, G.; Magdon, E. (Akademie der Wissenschaften der DDR, Berlin. Zentralinstitut fuer Krebsforschung). pp vp of XXII. Congress of Radiologists. Abstracts. Berlin, German, DDR; Gesellschaft fuer Medizinische Radiologie ([nd]). (In German)(CONF-8210198—Absts.).

From 22. congress of radiologists of the GDR; Karl-Marx-Stadt, German D.R. (25 Oct 1982).

8624 **Metabolic peculiarities of tumor cells underlying the selective modification of the radiosensitivity in radiotherapy.** Yarmonenko, S.P. (Akademiya Meditsinskikh Nauk SSSR, Moscow. Onkologicheskij Nauchnyj Tsentr). pp vp of XXII. Congress of Radiologists. Abstracts. Berlin, German, DDR; Gesellschaft fuer Medizinische Radiologie ([nd]). (In German)(CONF-8210198—Absts.).

From 22. congress of radiologists of the GDR; Karl-Marx-Stadt, German D.R. (25 Oct 1982).

8625 **Erythrocytic transketolase, glutathione reductase and aspartate aminotransferase activity in tumor patients treated with high dose thorax or abdominal irradiations.** Schmidt, W.; Wulff, K.; Reinke, A.; Grimm, U.; Knapp, A. (Ernst-Moritz-Arndt-Universitaet, Greifswald (German Democratic Republic). Radiologische Klinik). pp vp of XXII. Congress of Radiologists. Abstracts. Berlin, German, DDR; Gesellschaft fuer Medizinische Radiologie ([nd]). (In German)(CONF-8210198—Absts.).

From 22. congress of radiologists of the GDR; Karl-Marx-Stadt, German D.R. (25 Oct 1982).

8626 **Early radiation effects after radiotherapy of the thorax as revealed by electrocardiography.** Froehlich, D.; Adler, K.; Uhlmann, B.; Neumeister, K. (Bezirkskrankenhaus Karl-Marx-Stadt (German Democratic Republic)). pp vp of XXII. Congress of Radiologists. Abstracts. Berlin, German, DDR; Gesellschaft fuer Medizinische Radiologie ([nd]). (In German)(CONF-8210198—Absts.).

From 22. congress of radiologists of the GDR; Karl-Marx-Stadt, German D.R. (25 Oct 1982).

5603 Chemicals Metabolism And Toxicity

REFER ALSO TO CITATION(S) 7187, 7248, 8507, 8514, 8595

8627 **(CONF-8310240—2) Multielemental analysis of tree rings: temporal accumulation patterns and relationships with air pollution.** Baes, C.F. III; McLaughlin, S.B. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 13p. NTIS, PC A02/MF A01. Order Number DE84003320.

From Symposium on air pollution and the productivity of the forest; Washington, DC, USA (4 Oct 1983).

Short-leaf pine (Pinus echinata) tree rings collected in East Tennessee showed steadily increasing concentrations of Al, Cd, Cu, Fe, Mn, Mo, Ti, and Zn over the past 20 to 25 years. In part, these increasing concentrations result from recent declines in tree growth rate, but when corrected for variations in growth rate, annual accumulations of many of these metals in xylem tissue has increased in recent years. The largest concentration increases with time were observed in rings from trees downwind of the 1200 MW(e) generating Kingston steam plant, which burns 4×10^9 kg coal per year. Trace metals concentrations in cambial tissues were found to be as high as ten times those in the most recently formed xylem, and concentrations of Al, Cd, Mn, and Zn are near levels that have been associated with toxic effects when found in above-ground tissues of herbaceous plants. In trees sampled in the Great Smoky Mountains National Park (GSMNP) there was a period of suppressed growth and increased iron concentration in rings formed between 1863 and 1912. During this time period 88 km upwind, smelting of iron and copper sulfide ores was occurring at the Copper Basin (Copperhill), near Ducktown, Tennessee. Associated with this smelting were large uncontrolled releases of SO_2 which killed all vegetation within 20 km of the Copper Basin. The patterns of growth suppression and iron accumulation observed in the GSMNP trees correspond remarkably well to the initiation of smelting operations in 1854, maximum uncontrolled SO_2 emissions in 1895, and the reduction in SO_2 emissions mandated by the US Supreme Court in 1908. This historical pattern and the widespread occurrence of similar patterns of growth suppression and increased iron concentrations in tree rings since the late 1950s provide strong inferential evidence of tree response to SO_2 deposition. 36 references, 3 figures, 1 table.

8628 **(IFE/KR/E—82/007) Heavy metal exposure of human beings and environment from energy production. I. Mathematical models in exposure studies.** Brevik, E.M.; Christensen, G.C. (Institute for Energy Technology, Kjeller (Norway)). Oct 1982. 17p. (In Norwegian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750113.

Various types of mathematical models which are used in connection with heavy metals and other harmful compounds in the natural environment are briefly described. The potential usefulness of the various models is evaluated for use in a proposed main project. The exposure - commitment method will be of fundamental importance in the further work. 42 references.

8629 (INIS-BR—78, pp 109) **Accessibility of sulphydryl groups on the subunits of the acethylcholine receptor of Torped californica: effect of pre-incubation with specific ligands.** Souza Otero, A. de; Hamilton, S.L. (Texas Univ., Galveston (USA). Medical Branch). 1982. NTIS (US Sales Only), PC A07/MF A01. (CONF-821254—Summ.).

From 7. annual congress of the Brazilian Biophysics Society; Rio de Janeiro, Brazil (15 Dec 1982).

Published in summary form only.

8630 **(PNL-SA—11744) Toxic effects of occupational and environmental chemicals on the testes.** Sever, L.E.; Hessol, N.A. (Pacific Northwest Lab., Richland, WA (USA); Washington Univ., Seattle (USA). School of Public Health). 1983. Contract AC06-76RL01830. 76p. NTIS, PC A05/MF A01. Order Number DE84004842.

This paper examines evidence for effects of occupational chemicals on male reproduction. We consider primarily human data, and much of that from epidemiologic studies. We use animal studies to illustrate points, but the theme is the human experience. The approach is based on examining reproductive function as an indicator of toxic effects. Testicular structure and function is briefly discussed. We provide a brief review of relevant structure, function and hormonal control. We describe the anatomy of the testis and its histological structure. We then discuss the testis from the point of view of exocrine and endocrine function and the relationship of the testis to other endocrinological organs. This is followed by a review of methods for assessing human testicular function, including reproductive histories, sperm analysis, assessment of hormonal status, and histological studies. Although the primary focus is on human studies, we consider briefly general categories of chemicals shown to have a testicular effect in animal studies and also animal evidence of mechanisms of action associated with testicular toxicology. Specific chemicals shown to affect reproduction in the human male are reviewed and directions for future research in this area discussed.

8631 **(UCRL—88644) Effect of physicochemical form on copper availability to aquatic organisms.** Harrison, F.L. (Lawrence Livermore National Lab., CA (USA)). Nov 1983. Contract W-7405-ENG-48. 36p. (CONF-8304101—2). NTIS, PC A03/MF A01. Order Number DE84004884.

From 7. American Society of Testing and Materials symposium on aquatic toxicology; Milwaukee, WI, USA (17 Apr 1983).

Copper concentration and speciation were determined in influent and effluent waters collected from eight power stations that used copper alloys in their cooling systems. Quantities of copper associated with particles, colloids, and organic and inorganic ligands differed with the site, season, and mode of operation of the station. Under normal operating conditions, the differences between influent and effluent waters were generally small, and most of the copper was in bound (complexed) species. However, copper was high in concentration and present in labile species during start-up of water circulation through some cooling systems and during changeover from an open- to closed-cycle operation. Copper sensitivity of selected ecologically and economically important aquatic organisms was also evaluted. Our primary emphasis was on acute effects and most of the testing was performed under controlled laboratory conditions. However, sublethal effects of copper on a population of bluegills living in a power station cooling lake containing water of low pH were also assessed. The toxic response to copper differed with the species and life stage of the animal and with the chemical form of copper in the water.

8632 **Benzoquinolinediones: activity as insect teratogens.** Walton, B.T.; Ho, C.H.; Ma, C.Y.; O'Neill, E.G.; Kao, G.L. (Oak Ridge National Lab., TN). *Science (Washington, D.C.);* 222: 422-423(28 Oct 1983). Contract W-7405-ENG-26.

Morphological abnormalities including extra compound eyes, extra heads, and distally duplicated legs were generated in cricket embryos by treating eggs with single doses of either benz[g]isoquinoline-5,10-dione or benzo[h]quinoline-5,6-dione. Slight structural modifications of the molecules resulted in a loss of teratogenic activity, although embryotoxicity occurred. These potent insect teratogens can be used for analysis of developmental events during embryogenesis. 13 references, 4 figures, 1 table.

5604 Other Environmental Pollutant Effects

8633 **(AD-A—131737/9) Laser induced damage in the eye: study of energy deposition in the retina. Final report, 1 June 1976-31 May 1977.** McGowan, W.J.; Borwein, B.; Medeiros, J.A. (University of Western Ontario, London (Canada)). May 1977. 68p. NTIS, PC A04/MF A01.

This report summarizes the developments and accomplishments which occurred during year two of grant No. DAMD17-76-G-9419, Laser Induced Damage in the Eye. The project was to focus upon a detailed study of ultra-structural damage to the photo receptors and a complementary study of the optical properties of these receptors. As a result we have studied retinal damage and repair at both supra-threshold and low-level exposure conditions.

8634 **(AD-A—132045/6) Effect of pulsed 5.62 ghz microwaves on squirrel monkeys (saimiri sciureus) performing a repeated acquisition task. Final report.** Knepton, J.; de Lorge, J. (Naval Aerospace Medical Inst., Pensacola, FL (USA)). 28 Jan 1983. 21p. (NAMRL—1291). NTIS, PC A02/MF A01.

Navy personnel assigned to perform duties in the vicinity of microwave irradiating devices are subject to possible hazards if the irradiation is of adequate intensity and frequency. Data are of critical need to establish safety standards for human exposure to microwaves. In an effort to provide such information squirrel monkeys were trained on a task that required learning and were subsequently irradiated with microwaves while they performed the task. Four male squirrel monkeys trained to perform a repeated learning task demonstrated performance decay while being exposed to pulsed 5.62 GHz microwave radiation in the far-field situation at power densities of 38 and 46 mW/sq cm, but there was only slight learning impairment. There was little, if any, effect on learning or performance at 17 and 32 mW/sq cm. The performance effect became evident when the monkey's colonic temperature increased 1 C or more above the small increases that occurred during sham exposure. There was no evidence of either thermal or behavioral adaption, nor were there indications of lasting microwave effects. Specific absorption rate (SAR) values, obtained from saline and tissue-simulating models, coupled with the performance decay finding at 38 and 46 mW/sq cm indicate that special attention should be given to exposures of the head and extremities when establishing safety standards for human exposure.

8635 **(AD-A—132047/2) Restraint chair with rowing-like movement for exposing exercising nonhuman primates to microwave irradiation.** Knepton, J.; Ezell, C.; de Lorge, J. (Naval Aerospace Medical Inst., Pensacola, FL (USA)). 20 Apr 1983. 21p. (NAMRL—1298). NTIS, PC A02/MF A01.

Design and construction of a Styrofoam exercise restraint chair is described for use with rhesus monkeys exposed to microwaves. Monkeys usually learn the rowing-like motion of the device within five 1-hour conditioning sessions. Radiation intensity measure of the chair and an example animal experiment demonstrated the chair's suitability for bioelectromagnetic studies. Results of a series of base-line behavioral sessions demonstrated concomitant exercise work load effects on colonic temperature, heart rate, correct response rate, and post-reinforcement pause time. With additional instrumentation, detection of minute disturbances of integrated psychological and physiological mechanisms by unusual environmental factors may be possible.

8636 **(AD-A—132057/1) Effects of pulsed microwaves at 1.28 and 5.62 ghz on rhesus monkeys (Macaca mulatta) performing an exercise task at three levels of work. Final report.** Knepton, J.; de Lorge, J.; Griner, T. (Naval Aerospace Medical Inst., Pensacola, FL (USA)). 10 Mar 1983. 35p. (NAMRL—1293). NTIS, PC A03/MF A01.

The present experiment studies both behavioral and physiological consequences of exposing exercising rhesus monkeys to microwave radiation. At 1.28 Ghz four of the monkeys were exposed to power densities of 25, 41, and 89 mW/sg cm. At the highest power density exercising animals consistently had a lower response rate, a higher heart rate, and a greater increase in colonic temperature. At lower power densities the effects were generally less evident and were idiosyncratic. At 5.62 GHz five monkeys were exposed to power densities of 25, 41, and 89 mW/sg cm. Differences from controls were found only at 43 mW/sq cm: (1) colonic temperature averaged +0.8 C higher (N=2), (2) response rate decreased (N=5) when the heaviest work load occurred during the terminal third of the session, and (3) heart rate (N=2) was higher. These experiments demonstrate the microwaves will produce cardiovascular effects in addition to those produced by exercise alone and that body temperature induced by microwave energy does not seem to be further accelerated by exercise. The results also illustrate that monkeys working a physically arduous task are more likely to stop working when exposed to microwave than when working a less arduous task.

8637 **(AD-A—132065/4) Eruption of permanent dentition in rhesus monkeys exposed to ELF (extremely low frequency) fields. Interim report.** David, T.D.; Harris, G.A.; Bley, J.A. Jr. (Naval Aerospace Medical Inst., Pensacola, FL (USA)). Apr 1983. 26p. (NAMRL—1295). NTIS, PC A03/MF A01.

In a study initiated to determine the biological effects of ELF electric and magnetic fields associated with a submarine communications system ELF-exposed male rhesus monkeys gained weight at a slightly faster rate than control males. In order to obtain sufficient data on the physiological effects of electromagnetic fields, a second ELF study was initiated. Whereas the first study was initiated with wild-caught young adult animals, the second study utilized colony-bred animals beginning at 30 days of age. The emphasis of the second study was to substantiate previous findings and determine the underlying mechanisms involved. As in the first study, 30 primates (male and female) were exposed to the ELF electric and magnetic fields, and 30 control animals received the same care and treatment, but were not exposed. This report deals with the development of the permanent teeth relative to ELF exposure and sex. A consistent trend noted was that the teeth of female animals erupted at a slightly earlier age than males. However, no significant differences due to ELF exposure or sex were detected.

8638 **(ANL/ER-TM—83-3) Health and safety effects associated with electric and magnetic fields created by the New England Interconnection, +- 450 HVDC transmission line.** Pfanenstiel, W.E. (Argonne National Lab., IL (USA)). May 1983. Contract W-31-109-ENG-38. 82p. NTIS, PC A05/MF A01. Order Number DE84003306.

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A number of psychological and physiological responses of laboratory animals and humans have been attributed to exposure to electric fields, ion fields, and other phenomena associated with the operation of high-voltage electric power transmission lines. This review of the pertinent literature analyzes the potential for health and safety risks associated with operation of a proposed +- 450 KVDC transmission line from Quebec through Vermont to Monroe, New Hampshire. The operating parameters of the proposed line have been simulated by operating a test line of characteristics similar to the proposed line. Test line electric and ionic field level did exceed, on occasion, levels that have been associated with psychological or physiological responses in laboratory animals or humans. None of these responses are unequivocal indicators of harm. Such levels were achieved only for short periods of time and were restricted to an area within the proposed right-of-way. It is concluded that, although transient exposures to response-eliciting phenomena may occur in the proposed right-of-way, it is not reasonable to expect long-term or frequent exposure. Thus, the proposed line is not expected to pose a hazard to human health or safety.

8639 **(SIS-R—1982:5) Electrical fields in high voltage installations. A survey of electical fields under transmission lines, in substations and in power plants.** Waskaas, M. (Statens Inst. for Straalehygiene, Oslo (Norway)). Apr 1982. 64p. (In Norwegian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84750115.

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Electric field intensities are measured below overhead transmission lines, in substations and in 430 kV power stations in Norway. The intensities measured 1.8 m above the ground below the transmission lines, depend mainly on voltage level, the systems height above the ground and the tower designs. At constant voltage level, the intensities will decrease exponentially with increasing system height above the ground. the usual phase arrangements are horizontal-, vertical-, delta- and Y-arrangements in Norway. The electric field configurations below these lines differ in shapes in spite of equal voltage and system height above the ground. The field strength decrease rapidly outside its maximum at all phase arrangements and voltages. The electric field strength measured below two transmission lines running along each other had the same value as below a single transmission line at similar voltage and height above the ground. Trees, hedges and buildings under or in the vicinity of transmission lines act as effective electrostatic shields. Placing ground wires between the phases and the ground level is another effective way of shielding. Investigations at the high voltage sub- stations show that the workers are exposed to higher electric fields than the public may be exposed to below high voltage. The electric field intensity and magnetic flux density in a 430 MW power plant had low values in the engine room and along the bus bars. The measured magnetic flux densities were generally less than those produced by electric household appliances. The measured electric field intensities were negligible.

8640 **(SIS-R—1982:6) Biological effects of magnetic fields. A tabular survey.** Waskaas, M. (Statens Inst. for Straalehygiene, Oslo (Norway)). Apr 1982. 23p. (In Norwegian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750116.

The report is a literature study of the biological effects of various magnetic fields. The tables show effects of static and varying magnetic fields on human beings, animals and plants. Effects on in vitro systems are also tabulated. No abstracts or evaluations of the included publications are carried out. Thence no conclusions are drawn. 10 tables. 124 references.

57 Health And Safety

REFER ALSO TO CITATION(S) 8211, 8212

58 GEOSCIENCES

5801 Geology And Hydrology

REFER ALSO TO CITATION(S) 7143, 7144, 7282, 7283, 7296, 7299, 8448, 8550, 8559, 8649, 8663

8641 **(DOE/ET/46617—T4) Three-dimensional groundwater modeling in depositional systems, Wilcox Group, Oakwood salt dome area, east Texas.** Fogg, G.E.; Seni, S.J.; Kreitler, C.W. (Texas Univ., Austin (USA). Bureau of Economic Geology). 1983. Contract AC97-80ET46617. 58p. NTIS, PC A04/MF A01. Order Number DE84004338.

The data base includes not only measurements of hydraulic head and hydraulic conductivity but also lithofacies maps constructed in a previous study of Wilcox depositional systems. The Carrizo aquifer is a fairly homogeneous sand sheet overlying the much thicker Wilcox Group, a multiple-aquifer system composed primarily of fluvial channel-fill sand bodies distributed among lower permeability interchannel sands and muds. The interconnectedness of the channel-fill sands, which have predictable values of hydrau-

lic conductivity, strongly influences the rate and direction of ground-water flow. Lateral interconnectedness may depend largely on frequency distributions of channel-fill sands (that is, sand percent). Vertical interconnectedness is apparently poor owing to the horizontal stratification of sand and mud. Simulating observed pressure-depth trends by manipulating values of equivalent vertical hydraulic conductivity (K/sub v/') demonstrates that the ratio of vertical to horizontal conductivity (K/sub v/'/K/sub h/') is very low (about 10^{-3} to 10^{-4}). Locally high values of K/sub v/' could result in locally rapid vertical flow, which could in turn be detected using pressure-depth residence times of 10^3 to 10^4 years in channel-fill facies and 10^5 to 10^6 years in interchannel facies. Because Oakwood Dome is apparently surrounded by interchannel facies as a result of syndepositional dome growth, the dome may be essentially isolated from circulating Wilcox ground water. A possible exception is where channel-fill facies appear to touch or come close to the northeast flank, coinciding with a brackish-water plume that apparently results from dissolution of salt of cap rock. The northeast orientation of the plume appears to be caused by sand-body distribution and interconnection. 38 references.

8642 (INIS-mf—8299, pp 193-194) **Thermoluminescence dating of archaeological objects.** Mangini, A. (Heidelberg Univ. (Germany, F.R.). Inst. fuer Umweltphysik); Elitzsch, C.; Pernicka, E.; Wagner, G.A. 1983. (In German). NTIS (US Sales Only), PC A05/MF A01.

In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

TL dating for archaeometallurgical slags was further developed. For dose-rate determination the radioactive equilibrium was checked with α-spectrometry and pulse ionization chambers. TL dating was applied to ceramics from various prehistoric sites. (orig.).

8643 (NP—4770030, pp 1041-1046) **Geotectonical atlas of Northwestern Germany.** Kockel, F. [nd]. (In German). NTIS (US Sales Only), PC A99/MF A01.

In Status report 1982. Geotechnics and deposits. Vol. 2.

The subsurface mapping of NW-Germany which has been carried out within the research project 'Geotectonic atlas of NW-Germany' has been completed for more than the half of the region. The results are presented in the form of depth plans of selected geological horizons in the scale of 1:100,000 in the section of GK 100 together with a synoptical structure survey. A survey over the previously known structure types in NW-Germany which were analysed in their historical dynamics is given by profile cuts through selected structures.

8644 (NP—4770030, pp 1047-1054) **Investigations of the formation of natural gas deposits in the northern continuation of the underpermian Ems Valley.** Kettel, D.; Porth, H. [nd]. (In German). NTIS (US Sales Only), PC A99/MF A01.

In Status report 1982. Geotechnics and deposits. Vol. 2.

A basin study based on the evaluation of seismic data from a partial region of the Northwestern Upper Carbon basin leads to the conclusions: that far lateral migration paths for the Northwestgerman New Red Sandstone gases are unprobable; that in the future it will be possible to conclude from maturing calculations at seismic depth profiles the expected nitrogen content in natural gases in the order of their magnitude.

8645 (PNL—4882) **Geostatistics software user's manual for the Geosciences Research and Engineering Department PDP 11/70 computer.** Devary, J.L.; Mitchell, P.J.; Rice, W.A.; Damschen, D.W. (Pacific Northwest Lab., Richland, WA (USA)). Dec 1983. Contract AC06-76RL01830. 57p. NTIS, PC A04/MF A01. Order Number DE84004149.

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Geostatistics and kriging are statistical techniques that can be used to estimate a hydrologic parameter surface from spatially distributed data. The techniques produce statistically optimum estimates of a surface and can aid in pinpointing areas of greatest need for data. This document describes the use of geostatistical software routines that have been implemented at Pacific Northwest Laboratory's (PNL's) PDP 11/70 computer of the Geosciences Research and Engineering Department for use with the Hanford ground water monitoring data base of the Ground-Water Surveillance Program sponsored by U.S. Department of Energy. The geostatistical routines were modified to improve input/output file efficiency and to accept larger data sets. Two data processing routines were also developed for retrieving and sorting data into a form compatible with the geostatistical routines. 6 references, 9 figures, 1 table.

8646 (USGS-PP—1110-A-L) **Mississippian and Pennsylvanian (carboniferous) systems in the United States.** (Geological Survey, Reston, VA (USA)). 1979. 417p. GPO.

Summaries are presented of areal, stratigraphic, structural, and economic geology of Mississippian and Pennsylvanian rocks in the following states: Massachusetts, Rhode Island, Maine, Pennsylvania, New York, Virginia, West Virginia, Maryland, Ohio, Kentucky, Tennessee, Georgia, Alabama, Mississippi, Michigan, Indiana, and Illinois. (ACR)

8647 (USGS/WRIR—83-4171) **Geohydrologic data and test results from Well J-13, Nevada Test Site, Nye County, Nevada.** Thordarson, W. (Geological Survey, Denver, CO (USA). Water Resources Div.). 1983. 63p. NTIS, PC A04/MF A01. Order Number DE84004218.

Well J-13 was drilled to a depth of 1063.1 meters by using air-hydraulic-rotary drilling equipment. The well penetrated 135.6 meters of alluvium of Quaternary and Tertiary age and 927.5 meters of tuff of Tertiary age. The Topopah Spring Member of the Paintbrush Tuff, the principal aquifer, was penetrated from depths of 207.3 to 449.6 meters; a pumping test indicated its transmissivity is 120 meters squared per day, and its hydraulic conductivity is 1.0 meters per day. Below the Topopah Spring Member, tuff units are confining beds; transmissivities range from 0.10 to 4.5 meters squared per day, and hydraulic conductivities range from 0.0026 to 0.15 meter per day. Confining beds penetrated below a depth of 719.3 meters had the smallest transmissivities (0.10 to 0.63 meter squared per day) and hydraulic conductivities (0.0026 to 0.0056 meter per day). A static water level of about 282.2 meters was measured for the various water-bearing tuff units above a depth of 645.6 meters. Below a depth of 772.7 meters, the static water level was slightly deeper, 283.3 to 283.6 meters. Ground water sampled from well J-13 is a sodium bicarbonate water containing small concentrations of calcium, magnesium, silica, and sulfate, which is a typical analysis of water from tuff. Apparent age of the ground water, derived from carbon-14 age dating, is 9900 years. 15 references, 24 figures, 13 tables.

5802 Geophysics

REFER ALSO TO CITATION(S) 7224, 8644, 8663

8648 (CONF-8309104—3) **Three-dimensional dip analysis of offset VSP data.** Chun, J.H.; Jacewitz, C.A.; Lin, H.L. (Seismograph Service Corp., Tulsa, OK (USA)). 1983. Contract AC08-76NV00038. 32p. NTIS, PC A03/MF A01. Order Number DE84003872.

From International Society of Exploration Geophysicists meeting; Las Vegas, NV, USA (11 Sep 1983).

Often offset VSP data are available from only a few source positions. This creates difficulties with many standard imaging techniques. Using geometric ideas, a simple imaging technique is presented which is similar to a velocity spectra analysis of 2-D seismic data. The method involves a coherency measurement over the data along a traveltime curve corresponding to a specific dip and depth. The result for that dip and depth is placed appropriately (imaged). This coherency measurement is repeated for a range of dips at a specific depth. All depths are searched. This enables the construction of a dip spectrum of reflectors near a borehole. The dip spectrum contains information pertaining to the coordinates of source image points of reflectors. By the correlation study of coordinates of source image points obtained from a few source positions, the dip and strike of reflectors may be determined. This procedure locates the reflector in three dimensions if three source positions are available which do not lie on a straight line. 6 referenes, 19 figures.

8649 (N—8326229) **Comparison of three in situ surface soil moisture measurements and application to C band scatterometer calibration.** Bernard, R.; Taconet, O.; Vidal-Majar, D.; Thony, J.L.; Vauclin, M. (Centre de Recherches en Physique de l'Environnement, Issy-les-Moulineaux (France)). Oct 1982. 24p. (CRPE-NT—120). NTIS, PC A02/MF A01.

Surface gamma neutron probe, tensiometer and dielectric constant probe surface moisture measurements were compared to gravimetric sampling and C band scatterometer measurements, in order to find a system for ground truths during air or satellite-borne soil moisture experiments. Results for the three techniques are similar, but the dielectric probe is entirely automatic. Radar data calibrated with gravimetric sampling are comparable with dielectric measurements.

8650 (N—8326230) **Remote sensing in Sweden through the mid-80's.** (Swedish Space Corp., Solna). Aug 1982. 61p. NTIS, PC A04/MF A01.

The Swedish remote sensing program is outlined. Maritime surveillance, air pollution monitoring, meteorology, land applications, and cooperation with developing countries are discussed. Technology and methodology development, and information, education and research progams are outlined.

8651 (NP—4770030, pp 509-516) **Further development of the psophokinetic measuring probe.** Beckmann, H.; Burkhardt, M.; Brandt, A. [nd]. (In German). NTIS (US Sales Only), PC A99/MF A01.

In Status report 1982. Geotechnics and deposits. Vol. 2.

The research project 'Further development of the psophokinetic measuring probe' is concerned with the development and testing of a combined noise and caliber probe for narrow-scaled underground wells. The scraping noises shall give informations about the petrophysical data of elastical sediments, e.g. particle size and porosity. The geological interpretation of the noise analyses are supported by the determination of the well caliber.

8652 (NP—4770030, pp 517-528) **Seam wave seismical preliminary field exploration by digital data determination.** Brentrup, F.K.; Klinge, U. [nd]. (In German). NTIS (US Sales Only), PC A99/MF A01.

In Status report 1982. Geotechnics and deposits. Vol. 2.

The unexpected occurence of geologic-tectonic disturbances in bituminous coal seams leads to considerable hindrances of the exploitation. The statement possibilities of the seam wave seismology as a suitable process for the preliminary field exploration is tested within the research project and it is extended by improvements in the program development, the technical equipment of the measuring system and by model investigations. The measurements at an overthrust, over large distances and at an elutriation zone are presented by three examples. A valuation of the examinable results demonstrates the possibilities and the limitations of the process.

8653 (NP—4770030, pp 529-541) **Exploration of Ruhr coal deposit by seismic measurements and development wells.** Palm, H. [nd]. (In German). NTIS (US Sales Only), PC A99/MF A01.

In Status report 1982. Geotechnics and deposits. Vol. 2.

Within the long-term exploration program of the Ruhrkohle AG to exploit the reserve fields in the Lower Rhine-Westfalia bituminous coal region 68 development wells were drilled and 37.4 km profile seismic and 13.7 km^2 surface seismic measurements were carried out. The following deposits conditions of the reserve fields are noticeable: The stratigraphy and the tectonics of the overlying rock correspond generally to previous conseptions. The stratigraphy and the tectonics of the productive in partial regions explorated until now correspond to the developed and presently exploited parts of the deposits except for a generally higher depth of burial. Better conditions had been expected tendencially. A lowering of the grade of the deposit is partially observed from the south to the north and northwest due to lensing out or contamination of the seams.

8654 (NP—4770030, pp 543-560) **Preliminary field exploration in the bituminous coal mining with impulse radar.** Thyssen, F.; Schepers, R. [nd]. (In German). NTIS (US Sales Only), PC A99/MF A01.

In Status report 1982. Geotechnics and deoposits. Vol. 2.

A laboratory measuring station to determine the physical characteristics of coal has been built up and measurements have been carried out with samples from different seams. Underground radar measurements were carried out in the experimental mine Tremonia with a non-explosion-proof apparatus. The development of a intrinsicly safe radar apparatus for underground measurements has been chiefly terminated.

8655 (NP—4770030, pp 567-582) **Judgement of tectonical investigation methods in exploration regions of Ruhr mining.** Drozdzewski, G. [nd]. (In German). NTIS (US Sales Only), PC A99/MF A01.

In Status report 1982. Geotechnics and deposits. Vol. 2.

Additional specific tectonical investigations methods have been developed in the past for the exploration of Ruhr mining. The accuracy of the results obtained by well drilling and seismic investigations can be examined and judged because in the mean while some of the exploration regions have been reached by mining development. The great importance of tectonical investigations for the exploration is demonstrated by examples. Beside of this following presently applied and tested investigation methods are reviewed from the view of the present exploration of deposits: Wells, dip and variance measurements, seismology, roads, comperative structure analysis and structural petrology.

8656 (NP—4770030, pp 584-590) **Specialities of the tectonic claim at running out faults.** Sewing, H. [nd]. (In German). NTIS (US Sales Only), PC A99/MF A01.

In Status report 1982. Geotechnics and deposits. Vol. 2.

The change of the strikes and dips of the deposit and the faults and the size at the faults are investigated in the tectonics of the second order. Due to the change of size at faults a change of the strike direction of the faults is observed. Overthrusts and dip changes of the deposit often occur in the running out range of faults.

8657 (NP—4770040) **Investigations of seismoacoustic events in a bituminous coal seam of the Ruhr district.** Stoll, D. (Stuttgart Univ. (Germany, F.R.). Inst. fuer Geophysik). 9 Nov 1982. 106p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84770040.

Seismo-acoustic events, so-called "detonations", which had been measured in underground experiments in a bituminous coal seam in the Ruhr district, were analysed particularly with respect to focus parameters. It was found that the seismo-acoustic events result in all probability from shear fractures. The structures of the seismograms could be explained by regarding the seam as a wave conductor satisfactorily. The possibilities of position fixing were investigated with concern to future measurements.

8658 (PCCF-T—82-03) **"Radon-emanometry" applied to internal geophysics.** Seidel, J.L. (Clermont-Ferrand-2 Univ., 63 - Aubiere (France). Lab. de Physique Corpusculaire; Clermont-Ferrand-2 Univ., 63 - Aubiere (France)). Feb 1982. 96p. (In French). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84750242.

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An experimental set-up for in ground radon 222 measurements has been realised with solid state track detectors (cellulose nitrates CN85 and LR115). A preliminary study of radon activity variations has been conducted over various sites using radon as one of the forerunner geophysical parameters of volcanic eruptions and earthquakes predictions. The first data obtained in the field are presented: Etna (Sicily), Krafla (Iceland), Poas and Arenal (Costa Rica), Colima and Paricutin (Mexico) for active volcanoes, Ech Cheliff (Algeria) and Alsace (France) for seismotectonic areas.

8659 **Electrical conductivity, temperatures, and fluids in the lower crust.** Shankland, T.J.; Ander, M.E. (Geophysics Groups, Los Alamos National Laboratory). *Journal of Geophysical Research;* **88**: No. B11, 9475-9484(10 Nov 1983).

We have compiled both laboratory and worldwide field data on electrical conductivity to help understand the physical implications of deep crustal electrical profiles. Regional heat flow was used to assign temperatures to each layer in regional electrical conductivity models: we avoided those data where purely conductive heat flow suggested temperatures more than about 1000°C, substantially higher than solidus temperatures and outside the range of validity of heat flow models. The resulting plots of log conductivity σ versus 1/T demonstrate that even low-conductivity layers (LCL) have conductivities several orders of magnitude higher than dry laboratory samples and that the data can be represented by straight line fits. In addition, tectonically active regions show systematically higher conductivities than do shield areas. Because volatiles are usually lost in laboratory measurements and their absence is a principal difference between laboratory and field conditions, these materials probably account for the relatively higher conductivities of rocks in situ in the crust; free water in amounts of 0.01—0.1% in fracture porosity could explain crustal conductivities. Other possibilities are graphite, hydrated minerals in rare instances, and sulfur in combination with other volatiles. As most of the temperatures are less than 700°C, partial melting seems likely only in regions of highest heat flow where the conductive temperature profiles are inappropriate. Another result is that at a given temperature, crustal high-conductivity layes (HCL) are more conductive by another order of magnitude and show more scatter than do LCL's.

5803 Mineralogy, Petrology, And Rock Mechanics

REFER ALSO TO CITATION(S) 7234, 7265, 7282, 7283, 7293

8660 **(AD-A—131322/0) Cavity detection and delineation research. Report 2. Seismic methodology: Medford Cave site, Florida. Technical report, May 1979-November 1980.** Curro, J.R. Jr. (Army Engineer Waterways Experiment Station, Vicksburg, MS (USA). Geotechnical Lab.). Jun 1983. 103p. NTIS, PC A06/MF A01.

As part of a research program designed to find a quick and economical methodology to detect and delineate cavities, seismic technology was applied to the cavity problem at the Medford Cave site, Florida. Six seismic techniques consisting of surface refraction, constant-spacing, fan-shooting, surface shear-wave, uphole refraction, and crosshole investigations were employed at the site in an effort to detect and delineate cavity features. The results of these tests indicated that the surface refraction, constant-spacing, and crosshole techniques detected and partially delineated cavities. Their degrees of success varied. In summary, the constant-spacing technique is the only surface seismic test procedure recommended for use in cavity detection-delineation and the crosshole P-wave technique is the only subsurface method recommended.

8661 (NP—4770030, pp 1201-1209) **Rock mechanical plan of caverns in rock salt strata.** Rokahr, R.B.; Lux, K.H. [nd]. (In German). NTIS (US Sales Only), PC A99/MF A01.

In Status report 1982. Geotechnics and deposits. Vol. 2.

This presentation is concerned with some aspects of dimensioning of salt caverns and of laboratory experiments with rock salt. Initially a general review of works which were conducted within of rock mechanical investigations for the planning and design of caverns in salt strata is given. Subsequently some problems which are related to the formulation of viscous material laws and statements about the creep behaviour obtained with them are discussed based on the result of uniaxial creep tests. A comparative investigation to extrapolate laboratory space of times which are in the range of weeks and some months to space of times of about years which are relevant for caverns has been carried out in particular.

8662 (NP—4770030, pp 1211-1226) **Basic investigations to determine the hydrofracturing gradients of salt rocks.** Kiersten, P. [nd]. (In German). NTIS (US Sales Only), PC A99/MF A01.

In Status report 1982. Geotechnics and deposits. Vol. 2.

For the determination of the maximal permissible liquid pressure in caverns the knowledge of the so-called fracturing pressure gradient is necessary. It indicates in what measure the pressure should increase per meter of depth in order to induce the formation of fissures in the rock. A laboratory-scale measuring arrangement to investigate this gradient under different variables is presented. In this arrangement rock salt hollow cylinders can be stressed under different clamping conditions quasitriaxially and fractured by the application of an internal pressure.

8663 **(UCRL—53445) Characteristics of the Eleana Formation, Nevada Test Site.** Sweeney, J.J. (Lawrence Livermore National Lab., CA (USA)). 10 Nov 1983. Contract W-7405-ENG-48. 71p. NTIS, PC A04/MF A01. Order Number DE84004138.

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Data concerning the physical properties and the surface and subsurface occurrence of the Eleana Formation are compiled here, to assess argillite as a possible testing medium. This study focuses on the upper part of the formation, since the data are available and suitable units are also available for subsurface testing. The data are sufficient for a good characterization of physical properties, but the assessment of structural complexity is more difficult. Eventually, in an exploration phase, the physical properties and lithologic variations at a particular site can be well characterized with geophysical logging. A preliminary examination of published maps and cross sections leads to the conclusion that the sturcture of Paleozoic rocks at the NTS (particularly in the Yucca Flat area), is not well known. At this time, therefore, only a speculative assessment of the subsurface extent of Eleana Formation argillite can be made. 52 references, 32 figures.

8664 **Near surface heater test results: environmental implications for the disposal of high-level nuclear waste.** Krumhansl, J.L. (Sandia National Labs., Albuquerque, NM). *Radioactive Waste Management and the Nuclear Fuel Cycle;* **4**: No. 1, 1-31(Sep 1983). Contract AC04-76DP00789.

Near surface experiments employing waste canister sized electric heaters were carried out in shale at two localities. Conduction, rather than steam convection, was found to be the primary mode of heat transfer. Thermally induced cracking of the rock was documented in one instance, but failed to result in either significant spalling of the heater hole walls or a drastic decrease in formation thermal conductivity. The most corrosive environment developed during the experiment coincided with the region of steam condensation on top of the heater. A sample of waste glass simulant maintained to roughly 60°C in an ancillary instrumentation hole altered to form a rind up to 20 μm thick. The only significant mineralogic change in the host rock was iron pyrite oxidation; clay minerals were generally found to be unreactive. Based on these experiments and the results of numerical models it is concluded that near surface tests can provide valuable insights into the workings of an actual repository at depth. 10 references, 11 figures, 4 tables.

5804 Geochemistry

REFER ALSO TO CITATION(S) 7189, 7294

8665 (NP—4770030, pp 1055-1062) **Geochemical hydrocarbon prospection in the Eastern Chinese Sea.** Faber, E.; Stahl, W.; Dumke, I. [nd]. (In German). NTIS (US Sales Only), PC A99/MF A01.

In Status report 1982. Geotechnics and deposits. Vol. 2.

Two sampling cruises have been undertaken in the Eastern Chinese Sea within a cooperation with chinese partners after the provision of necessary equipment. 155 sediment samples were collected. The determinations of the adsorbed amounts of gas and the carbon isotope analyses were carried out on board and in the BGR Laboratory. The results of the surface investigations shall be compared with the results of a planned deep well.

8666 (NP—4770030, pp 1075-1083) **Analytical isotope geochemistry of C,S,N - application to the exploration of petroleum in the Southgerman region.** Hirner, A.V.; Graf, W.; Melzer, A.N. [nd]. (In German). NTIS (US Sales Only), PC A99/MF A01.

In Status report 1982. Geotechnics and deposits. Vol. 2.

Petroleum samples from 11 localities in the Southern German molasse basin were analysed with respect to the distribution of the stable isotopes of sulfur. An average isotope difference of 19per mille could be detected for the Trias-Lias oils of the western molasse and the tertiary basis oils of the molasse. Delta^{34} determinations at fractions of bacterially not degraded petroleums led to the result that probably a correlation between the ^{34}S accumulation and the molecular weight of the compound exists.

5805 Oceanography

REFER ALSO TO CITATION(S) 8474

8667 (DOE/EV/00901—7) **Coordination: southeast continental shelf studies. Progress report.** Menzel, D.W. (Skidaway Inst. of Oceanography, Savannah, GA (USA)). 12 Dec 1983. Contract AS09-76EV00901. 31p. NTIS, PC A03/MF A01. Order Number DE84004165.

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Activities associated with research on the oceanography of the South Atlantic Bight are discussed. These include (1) a summary of past research, (2) use of the Savannah River Navigational Light Tower as a meteorological/oceanogrpahic monitoring station, and (3) use of research vessels. The research program has attempted to describe the influences of the Gulf Stream and other forcing functions on physical, chemical and biological processes of the outer and mid-continental shelf. (ACR)

8668 (DOE/EV/05163—7) **Measurement of gulf stream and wind induced shelf circulation in the South Atlantic Bight. Progress report, June 1, 1982-May 31, 1984.** Lee, T.N. (Miami Univ., FL (USA). Rosenstiel School of Marine and Atmospheric Sciences). Dec 1983. Contract AS05-76EV05163. 17p. NTIS, PC A02/MF A01. Order Number DE84004911.

The work reported here involves an investigation of physical processes in the shelf waters off Georgia and north Florida. The objective is to improve the capability for prediction of the physical environment. The principal task was to determine the relative importance of the forces driving shelf circulation and exchange and to measure the shelf waters' response over variable time and space scales. Results to date are summarized. (ACR)

8669 (INIS-mf—8230) **Development of an experimental set-up for the measurement of acoustic attenuation in seawater and studies of the usefulness of acoustic attenuation as a parameter in oceanographic research.** Barkmann, R. (Kiel Univ. (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet). 7 Jul 1982. 91p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE83703960.

A senson element is described for the measurement of ultrasound wave attenuation in water. This device has been developed for in-situ measurements of the additional attenuation caused by particles or air bubbles. Results are presented for the attenuation variations induced by ions and solid-state particles. The method is based on the emission of an 80 μs acoustic sine wave burst at about 10 MHz in a water container of 10 cm length. Then the amplitudes of the decaying echos are registrated, which are caused by reflections at the transducer and the reflector. The sound attenuation coefficient is obtained from the amplitude ratio of the first two echos, taking into account corrections caused by diffraction and reflection effects.

64 PHYSICS. I.

6401 Astrophysics And Cosmology

REFER ALSO TO CITATION(S) 8740, 8986

8670 (AD-P—001441/5) **Relativistic solar particle events during STIP (study of travelling interplanetary phenomena) intervals II and IV.** Shea, M.A.; Smart, D.F. (Air Force Geophysics Lab., Hanscom AFB, MA (USA)). 27 Dec 1982. 14p. NTIS, PC A02/MF A01.

Using spaceship 'Earth' as a detector located at 1 AU, the relativistic solar cosmic ray events of 30 April 1976 and 22 November 1977 are compared to deduce the relativistic solar particle flux anisotropy and pitch angle characteristics in the interplanetary medium. These two ground level events occurred during STIP Interval II and IV respectively - periods of time of coordinated and cooperative scientific efforts.

8671 (AD-P—001445/6) **Theoretical MHD (magnetohydrodynamic) simulations of coronal transients and interplanetary observations.** Dryer, M.; Steinolfson, R.S.; Smith, Z.K. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Environmental Research Labs.). 27 Dec 1982. 15p. NTIS, PC A02/MF A01.

A major long-range goal of theoretical simulations of solar-generated disturbances (transients, coronal holes, etc.) is the realistic modeling of a propagating disturbance from the sun into and throughout interplanetary space. Simulations of this kind, using MHD fluid theory, must always be confronted with observations in order to assess the degree to which one or the other is inadequate. We describe some of this on-going work which is concerned with both one- and two-dimensional, time-dependent MHD simulations. The first example simulates a flare-produced coronal transient. In this case, a sudden current pulse is assumed to produce emerging magnetic flux. This 'magnetic pulse' is sufficient to drive a weak shock wave into the solar wind by virtue of an outwardly-directed Lorentz force. The pulse is assumed to consist of a linearly-increasing (with time) magnetic field of 0.72 G at the base of a closed magnetic topology (initially in hydrostatic equilibrium) to a value ten times larger over a 10-minute period. The shock achieves a velocity of 230 km/s (which would be superimposed upon the existing solar wind). A second example deals with a series of corotating interaction regions observed during a 60-day period by Pioneers 10 and 11 in 1973 prior to, during, and subsequent to the former spacecraft's flyby of Jupiter. An opportunity for a stringent test of our one-dimensional model was made possible by the nearly radial alignment of these two spacecraft.

8672 (CENBG—8201) **Nuclear reactions and application to production rates of krypton in extraterrestrial materials.** Lavielle, B. (Bordeaux-1 Univ., 33 - Gradignan (France). Centre d'Etudes Nucleaires; Bordeaux-1 Univ., 33 (France)). 1982. 96p. (In French). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84750227.

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Noble gases have been largely outgassed from most solar system materials through several heating processes. Consequently, their cosmogenic component, produced by cosmic-ray-induced nuclear reactions near the surface of atmosphere-free planetary objects, is detectable in meteorites and lunar samples. This work deals with the production of cosmogenic Krypton in the four main targets Zr, Y, Sr and Rb. Excitation functions of Krypton isotopes with A = 78, 80, 81, 82, 83, 84, 85 and 86 were mass-spectrometrically measured in Y and Zr targets bombarded with 0.059, 0.075, 0.168, 0.200, 1.0, 2.5 and 24 GeV protons. Also the Krypton relative cross sections were measured in Sr at 0.168 GeV. The results, combined with a general survey of nuclear reactions in Ga to Nb targets, permitted the development of new systematics in order to estimate unknown cross-sections in Rb and Sr. Measured and estimated excitation functions allowed to calculate the concentrations and isotopic ratios of cosmogenic Krypton in same well-documented lunar samples. Compared to observed values in 9 rocks, ^{83}Kr is predicted with a precision better than 33% and the production

ratios sup(i)Kr/^{83}Kr are predicted to better than 25%. Also it is concluded that the cosmogenic ratios ^{86}Kr/^{83}Kr and ^{81}Kr/^{83}Kr are dependent on the main target elements concentrations.

8673 **(EML—420) Production of krypton-81 and krypton-85 by cosmic rays.** O'Brien, K. (USDOE Environmental Measurements Lab., New York). Nov 1983. 17p. NTIS, PC A02/MF A01. Order Number DE84004439.

Calculations of the inventory of cosmogenic ^{81}Kr and ^{85}Kr have been carried out based on the spallation cross sections of Silberbeg and Tsao and on experimental radiative-capture cross sections. The resulting production rates were converted to inventories, accounting for variations in solar activity level and in geomagnetic field strength. The results are within about a factor of two of previous estimates. 12 references, 1 figure.

8674 (INIS-mf—8299, pp 159-160) **Dating of individual chondrules and their petrographic and chemical characterization.** Kurat, G. (Naturhistorisches Museum Wien (Austria)); Herrwerth, I.; Jessberger, E.K.; El Goresy, A.; Kirsten, T.; Mueller, N.; Pernicka, E. 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

^{40}Ar-^{39}Ar-dating of individual chrondrules, which were petrographically and chemically characterized, was continued. ^{40}Ar-^{39}Ar-ages range from 4.4 to 4.6 billion years and thus cover a time interval, which cannot be reconciled with current theoretical calculations predicting a comparatively narrow time span needed for the formation of mm-sized particles in the early solar system. Surface-correlated argon is indicated in the younger chondrules which would exclude thermal stress of those chondrules and ^{40}Ar-diffusion-losses as an explanation for their relatively low ages. The higher ages are obtained for structurally and chemically peculiar chondrules. The interference, however, that these ages are due to the admixture of presolar ^{40}Ar from the present data is premature.

8675 (INIS-mf—8299, pp 180-181) **Cosmic rays.** Dorfi, E.; Drury, L.; Moraal, H.; Voelk, H.J.; Webb, G. (Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.)); Axford, W. (Victoria Univ., Wellington (New Zealand)); Biermann, P. (Max-Planck-Institut fuer Radioastronomie, Bonn (Germany, F.R.)); Bogdan, T. (Chicago Univ., IL (USA)); Heavens, A. (Cambridge Univ. (UK)); McKenzie, J. (Natal Univ., Durban (South Africa)). 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

Various aspects of cosmic ray acceleration, in particular diffusive shock acceleration, were considered.

8676 (INIS-mf—8299, pp 181) **Interaction of clouds with the hot interstellar medium (HIM) and cosmic rays.** Voelk, H.J. 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

The modification, by cosmic rays, of the interaction of interstellar clouds with the ambient HIM is considered. Small clouds should still evaporate and thereby exclude cosmic rays if they do so without cosmic rays. The possible mass accretion of massive clouds is reduced by the pressure of the compressed cosmic rays. The consequences for diffuse galactic γ-ray emission are discussed.

8677 (INIS-mf—8299, pp 181) **Velocity fluctuations in the interstellar medium due to gravitational interactions with stars.** Kegel, W.H. (Frankfurt Univ. (Germany, F.R.). Inst. fuer Theoretische Physik); Voelk, H.J. 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

The gravitational interaction between stars and interstellar gas leads to the excitation of velocity fluctuations. The relevance of the results for the interpretation of interstellar lines, the large scale flow, and cloud collapse is pointed out.

8678 **(INIS-mf—8631) Mass transfer in stellar X-ray sources.** Verbunt, F. (Rijksuniversiteit Utrecht (Netherlands)). 7 Jul 1982. 114p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE83704735.

This thesis deals with mass transfer in the binary stars that emit X-rays. Optical observations on two sources are presented: 2A0311-227 and Cen X-4. The transferred matter will often enter a gaseous disk around the compact star, and spiral inwards slowly through this disk. The conditions for the formation of such a disk are investigated and the equations governing its structure are presented. Different models are discussed and it is concluded that different models lead to very similar results for those regions of the disk where gas pressure is more important than radiative pressure, and that these results agree fairly well with observations. No consistent model has been constructed as yet for the region where radiative pressure is dominant. Theoretically one predicts that the optical light emitted by a disk around a neutron star is mainly caused by X-ray photons from the immediate surroundings of the neutron star that hit the outer disk surface, are absorbed, thermalised, and re-emitted in the optical and ultraviolet regions of the spectrum. This expectation is verified by comparison with the collected observational data of low-mass X-ray binaries. Finally the author investigates which mechanism is responsible for the mass transfer in systems where the mass-losing star is less massive than the sun.

8679 **(INIS-mf—8633) Ca II H and K emission from late-type stars.** Middlekoop, F. (Rijksuniversiteit Utrecht (Netherlands)). 5 Jul 1982. 93p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE83704736.

This thesis is based on a study of the Ca II H and K emission features of late main-sequence stars. In Chapter II it is shown that rotation periods can be determined from a modulation in the Ca II H and K signal for many stars in a broad range of spectral types. In Chapter III it is shown that a clear correlation exists between Ca II H and K emission and rotational velocity in active main-sequence stars. There is an indication for a (probably colour-dependent) critical velocity at which the Ca II H and K emission suddenly drops. Chapter IV discusses the dependence of Ca II H and K emission on the rotation rate for evolved stars.

8680 **(INIS-mf—8648) Seyfert galaxy population. A radio survey; luminosity functions; related objects.** Meurs, E. (Rijksuniversiteit Leiden (Netherlands)). 14 Jun 1982. 138p. NTIS (US Sales Only), PC A07/MF A01. Order Number DE83704737.

A large sample of Seyfert galaxies, many of which are Markarian galaxies, has been observed with the WSRT in lambda 21 cm continuum radiation. The results are presented, and the number of radio detected Seyferts has now increased considerably. A number of accurate optical positions are given that were needed to identify radio sources with the Seyfert galaxies observed. Optical and radio luminosity functions of Seyfert galaxies are derived. The results are compared with such functions for other categories of objects that may be related to these galaxies. The discussions focus on the possible connections between normal galaxies, Seyferts, and optically selected quasars. Three investigations are reported on individual objects that are related to Seyfert galaxies. WSRT observations of four bright, optically selected quasars are presented. The identification of an X-ray discovered BL Lacertae object is discussed. Its radio emission is on a much lower level than for other BL Lacs. Perhaps it is a radio-quiet object in this class, suggesting a comparable difference in radio emission for BL Lacs as is known for quasars. Photo-electric photometry for the Seyfert galaxy NGC 1566 is reported. Besides a monitoring programme, multi-aperture photometry is described.

8681 **(INIS-mf—8660) Sunspots and the physics of magnetic flux tubes in the sun.** Ballegooijen, A.A. van. (Rijksuniversiteit Utrecht (Netherlands)). 29 Nov 1982. 115p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE83704738.

This thesis refers to the sub-surface structure of the solar magnetic field. Following an introductory chapter, chapter II presents an analysis of spectroscopic observations of a sunspot at infrared wavelengths and models of the temperature stratification in the sunspot atmosphere are derived. The main subject of this thesis concerns the structure of the magnetic field deep down below the stellar surface, near the base of the convective envelope. In Chapter III the stability of toroidal flux tubes to wave-like perturbations

is discussed, assuming that the tubes are neutrally buoyant. A model is proposed in which the toroidal flux tubes are neutrally buoyant and located in a stably stratified layer just below the base of the convective zone. On the basis of some simple assumptions for the temperature stratification in this storage layer the author considers in Chapter IV the properties of the vertical flux tubes in the convective zone. The adiabatic flux model cannot satisfactorily be applied to the simplified model of the storage layer, so that the problem of magnetic flux storage is reconsidered in Chapter V. A new model of the temperature stratification at the interface of convective zone and radiative interior of the sun is described. Finally, in Chapter VI, the stability of toroidal flux tubes in a differentially rotating star are discussed. It is demonstrated that for realistic values of the magnetic field strength, rotation has a strong effect on the stability of the toroidal flux tubes.

8682 (LA-UR—83-3215) Constraints on stellar evolution from pulsations. Cox, A.N. (Los Alamos National Lab., NM (USA)). 1983. Contract W-7405-ENG-36. 20p. (CONF-8309172—5). NTIS, PC A02/MF A01. Order Number DE84003787.

From IAU symposium on observational tests of stellar evolution theory; Geneva, Switzerland (12 Sep 1983).

Consideration of the many types of intrinsic variable stars, that is, those that pulsate, reveals that perhaps a dozen classes can indicate some constraints that affect the results of stellar evolution calculations, or some interpretations of observations. Many of these constraints are not very strong or may not even be well defined yet. In this review we discuss only the case for six classes: classical Cepheids with their measured Wesselink radii, the observed surface effective temperatures of the known eleven double-mode Cepheids, the pulsation periods and measured surface effective temperatures of three R CrB variables, the δ Scuti variable VZ Cnc with a very large ratio of its two observed periods, the nonradial oscillations of our sun, and the period ratios of the newly discovered double-mode RR Lyrae variables. Unfortunately, the present state of knowledge about the exact compositions; mass loss and its dependence on the mass, radius, luminosity, and composition; ;and internal mixing processes, as well as sometimes the more basic parameters such as luminosities and surface effective temperatures prevent us from applying strong constraints for every case where currently the possibility exists.

8683 (LA-UR—83-3216) Some investigations about the Carson opacities. Cox, A.N.; Kidman, R.B. (Los Alamos National Lab., NM (USA)). 1983. Contract W-7405-ENG-36. 6p. (CONF-8309172—4). NTIS, PC A02/MF A01. Order Number DE84003785.

From IAU symposium on observational tests of stellar evolution theory; Geneva, Switzerland (12 Sep 1983).

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Accurate opacities for stellar composition mixtures are needed for all studies of stellar structure, evolution, stability, and pulsation. Three problem areas where increased opacities would be welcome are: the observed broadening of the upper main sequence that can be produced with larger opacities that tend to expand the stars; the existence of the double-mode Cepheids and their anomalously low period ratios which can be predicted to be lower, as observed, if opacities are larger; and the small sensitivity of the low mass population II horizontal branch luminosity to the metal content of their compositions that would be more effective if their opacity were increased. Several other problems that could be solved by larger opacities have been widely discussed, but we feel that they are not justifiably an opacity problem. The conclusion of our considerations are that the Thomas-Fermi method for getting opacities used by Carson and his collaborators does not produce values appreciably different from those obtained without this method at Los Alamos, and that these persistent astrophysical problems must be solved in other ways. We here propose a possible error in the Carson opacities, and, further, we mention another that seems to be the correct reconciliation between these two opacity sets.

8684 (LA-UR—83-3704) Solar flares: an extremum of reconnection. Colgate, S.A. (Los Alamos National Lab., NM (USA)). 22 Dec 1983. Contract W-7405-ENG-36. 11p. (CONF-8310229—2). NTIS, PC A02/MF A01. Order Number DE84004413.

From Chapman conference on magnetic reconnection; Los Alamos, NM, USA (3 Oct 1983).

Portions are illegible in microfiche products.

Three points are emphasized: that the solar flare is that particular astrophysical phenomenon that is the extremum of reconnection, no other phenomenon demands as rapid magnetic flux annihilation as is seen in the solar flare; that plasma physics experiments can and should be performed in the laboratory that model reconnection as we observe it in astrophysics; and that stochastic field lines derived from something similar to Alfven wave turbulence are a necessary part of reconnection.

8685 (PB—83-243451) Soft x-ray polychromator for the solar maximum mission: inner-shell transitions in Fe XIX-XXII in the x-ray spectra of solar flares and tokamaks. Phillips, K.J.H.; Leman, J.R.; Cowan, R.D.; Doschek, G.A.; Leibacher, J.W. (Rutherford Appleton Lab., Chilton (UK)). [nd]. 43p. (RL—82-059). NTIS, PC E04/MF E04.

X-ray spectra of solar flares and laboratory plasmas containing iron exhibit lines near 1.9A arising from 1s-2p transitions in the presence of other non-participating electrons. Spectra of the ions FeXIX to Fe XXII were calculated for various electron densities and temperatures. Calculations were based on a code that computed both the level structure of an ion and intensity fraction for the 1s-2p satellite lines. Several transitions had intensities which varied with electron density. Calculated spectra were compared with those recorded by the P78-1 and SMM spacecraft. Good agreement was found, particularly between the Fe XX lines, which are density sensitive, and the calculated spectrum of a low electron density plasma. The predicted density variation of the Fe XX lines was confirmed by spectra obtained from higher density laboratory plasmas.

8686 (UCRL—89914) Applications for fission product data to problems in stellar nucleosynthesis. Mathews, G.J. (Lawrence Livermore National Lab., CA (USA)). Oct 1983. Contract W-7405-ENG-48. 25p. (CONF-8310104—8). NTIS, PC A02/MF A01. Order Number DE84004819.

From Specialists meeting on yields and decay data of fission product nuclides; Upton, NY, USA (24 Oct 1983).

A general overview of the nucleosynthesis mechanisms for heavy ($A \geq 70$) nuclei is presented with particular emphasis on critical data needs. The current state of the art in nucleosynthesis models is described and areas in which fission product data may provide useful insight are proposed. 33 references, 10 figures.

8687 (UCRL—90009) Piecewise-parabolic methods for astrophysical fluid dynamics. Woodward, P.R. (Lawrence Livermore National Lab., CA (USA)). 1 Nov 1983. Contract W-7405-ENG-48. 84p. (CONF-820836—2). NTIS, PC A05/MF A01. Order Number DE84003193.

From NATO advanced study institute on radiation hydrodynamics; Munich, F.R. Germany (2 Aug 1982).

A general description of some modern numerical techniques for the simulation of astrophysical fluid flow is presented. The methods are introduced with a thorough discussion of the especially simple case of advection. Attention is focused on the piecewise-parabolic method (PPM). A description of the SLIC method for treating multifluid problems is also given. The discussion is illustrated by a number of advection and hydrodynamics test problems. Finally, a study of Kelvin-Helmholtz instability of supersonic jets using PPM with SLIC fluid interfaces is presented.

8688 Long-term captures of low-mass intruders by binary stars. Hills, J.G. (Theoretical Division, Group T-6, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Astronomical Journal;* **88**: No. 12, 1857-1867(Dec 1983).

Intensive computer simulations were made of three families of encounters between a binary star and a low-mass intruder which

previous work indicated have a high probability of producing long-lived triple-star systems. For comparison, a fourth family which produces few long-lived trinaries was also studied. In the first two families, the binary components are equally massive and the closest approach of the intruder to the center of mass of the binary is about two times its semimajor axis, a_0. In Family 1, the orbit of the original binary is circular, $e = 0$, while in Family 2, $e_0 = 0.95$. In Family 3 one binary component is 100 times as massive as the other, the orbit is circular, and the low-mass intruder enters the binary at nearly zero impact parameter. The probability that the intruder is trapped for at least one revolution around the binary is 0.24, 0.46, and 0.51, respectively, for these three families of encounters. The fraction of the intruders surviving successive revolutions drops rapidly. However, one encounter in Family 1 and two in Family 3 resulted in the intruder making more than 300 revolutions around the inner binary before escaping. Some intruders remained bound for more than 20 000 revolutions of the inner binary. The longest duration captures occur when the intruder is thrown into an orbit with a very large semimajor axis. About 20% of the encounters in the three families result in the intruder being thrown into an orbit with a semimajor axis $a > 100\ a_0$, while about 2% result in the intruder going into an orbit with $a > 1000\ a_0$. Intruders thrown into these large semimajor axis orbits have the best chance of having their orbits stabilized by passing stars.

8689 **Monopole catalysis of nucleon decay in old pulsars.** Freese, K.; Turner, M.S.; Schramm, D.N. (Astronomy and Astrophysics Center, Enrico Fermi Institute, The University of Chicago, Chicago, Illinois 60637). *Physical Review Letters;* **51**: No. 18, 1625-1628(31 Oct 1983). Contract AC02-80ER10773.

The measured x-ray fluxes of old, nearby pulsars are used to constrain the monopole flux times the cross section for monopole-catalyzed nucleon decay. Observations of PSR 1929+10 provide the best limit: $F \times \sigma v/(3 \times 10^{-10}\ cm^3\ s^{-1}) <$ or $= 7 \times 10^{-22}\ cm^{-2}\ sr^{-1}\ s^{-1}$. When the monopoles captured by the progenitor star while it was on the main sequence are taken into account, the limit becomes $F \times \sigma v/(3 \times 10^{-10}\ cm^3\ s^{-1}) <$ or $= 2 \times 10^{-25}\ cm^{-2}\ sr^{-1}\ s^{-1}$.

8690 **Infrared and optical star counts in the plane of the galaxy.** Eaton, N. Leicester, England; Leicester University (1982). 208p. British Library, Boston Spa, Wetherby, West Yorks. No. D43597/82.

Infrared and optical star counts have been obtained to investigate the stellar distribution in the plane of the Galaxy. The discovery of an obscured infrared cluster of sources is presented and a search technique for finding such obscured sources using visible and near-infrared plates is discussed. The techniques and mathematical treatment of star counting are described and, as an introduction, a literature review of the galactic structure is given.

8691 **Detailed study of the reflection nebula, NGC 7023.** Moore, P.J.R.M. Durham, England; Durham University (1982). 187p. British Library, Boston Spa, Wetherby, West Yorks. No. D44673/83.

Polarisation and intensity maps in three broad wavebands are presented for the reflection nebula NGC7023. The data are used to investigate the structure, dust distribution and grain characteristics of the material surrounding the central illuminating star HD200775 of the reflection nebula. Calculations have been made, using a Monte Carlo technique, for various parameters representing the structure and content of the nebula to predict and explain the observed measurements.

8692 **Cosmology with primordial black holes.** Lindley, D. Brighton, England; Sussex University (1981). 278p. British Library, Boston Spa, Wetherby, West Yorks. No. D44948/83.

Cosmologies containing a substantial amount of matter in the form of evaporating primordial black holes are investigated. A review of constraints on the numbers of such black holes, including an analysis of a new limit found by looking at the destruction of deuterium by high energy photons, shows that there must be a negligible population of small black holes from the era of cosmological nucleosynthesis onwards, but that there are no strong constraints before this time. The major part of the work is based on the construction of detailed, self-consistent cosmological models in which black holes are continually forming and evaporating. The interest in these models centres on the question of baryon generation, which occurs via the asymmetric decay of a new type of particle which appears as a consequence of the recently developed Grand Unified Theories of elementary particles. Unfortunately, there is so much uncertainty in the models that firm conclusions are difficult to reach; however, it seems feasible in principle that primordial black holes could be responsible for a significant part of the present matter density of the Universe.

6402 Atmospheric Physics

REFER ALSO TO CITATION(S) 8673

8693 **(AD-A—131173/7) Neutral flow through ion clouds. Technical report.** Prettie, C.W. (Berkeley Research Associates, Inc., CA (USA)). 1 Dec 1982. 68p. NTIS, PC A04/MF A01.

Ionospheric plasma clouds exert a drag force on the neutrals flowing through them which is generally neglected in plasma evolution analyses. This drag force can be significant in barium clouds and in late time HANE plasma. The interaction between these two flows and its influence on plasma evolution and structuring are considered and presented in this report. Based on momentum considerations alone the neutral slip speed past barium ions is reduced by 1 meter per second for every 1.7×10^{15} ions per meter squared it passes through. This significant deceleration may be considerably reduced in small or high altitude barium clouds by viscous forces; however, in many cases ion clouds produce a wake in the neutral flow. The wake of the neutral wind passing through barium clouds affects its evolution according to the cloud size, altitude, and peak ion density. The interaction between ions and neutrals may explain morphological differences between the evolution of large SPRUCE-, ESTHER- and IRIS- like clouds and small Avefria Dos-like ion clouds. The results of numerical simulations of these two different types of clouds with coupled ion-neutral flow are presented which show a tendency for the large cloud to bifurcate. The possibility that ion-neutral interaction creates neutral turbulence which in turn leads to plasma structuring is also investigated.

8694 **(AD-A—131250/3) Some classical mechanisms influencing the high-altitude nuclear environment. Technical report.** Sperling, J.L.; Hamasaki, S. (JAYCOR, San Diego, CA (USA)). 15 May 1982. 87p. NTIS, PC A05/MF A01.

Classical mechanisms (e.g., collisions, chemistry, single particle dynamics, and radiation) are necessary, basic ingredients in theoretical and numerical representations of the high-altitude nuclear environment. This report is a compilation of three separate papers, each of which describes and analyzes a classical mechanism which can influence the ionospheric and magnetospheric environments following a high-altitude nuclear burst. The three mechanisms considered are (1) charge exchange, (2) radiative recombination, and (3) nonadiabaticity.

8695 **(AD-A—131355/0) Propagation of wide bandwidth signals through strongly turbulent ionized media. Technical report.** Knepp, D.L. (Mission Research Corp., Santa Barbara, CA (USA)). 15 Mar 1982. 248p. (MRC-R—671). NTIS, PC A11/MF A01.

Analytic and numerical techniques are presented which directly address the problem of propagation of wide bandwidth signals through random ionized media. This work is applicable to the problems of satellite communication and space based radar observation through a disturbed ionospheric propagation channel that would result from a high altitude chemical release or nuclear detonation.

8696 **(AD-A—131773/4) Stimulation of ULF (ultra-low-frequencies) geomagnetic pulsations by controlled VLF (very-low-frequencies) transmissions into the magnetosphere. Technical report January 1975-February 1977.** Fraser-Smith, A.C.; Helliwell, R.A.; Bell, T.F.; Crystal, T.L.; Dingle, B. (Stanford Univ., CA (USA). Stanford Electronics Labs.). Dec 1977. 64p. NTIS, PC A04/MF A01.

This report presents the results of an investigation of a proposed method for the controlled artificial generation of ultra-low-frequency (ULF) hydromagnetic waves of class Pc 1 (0.2 to 5 Hz) in the ionosphere and magnetosphere. In this method, which is called the VLF method, a large ground-based very-low-frequency (VLF) transmitter is used to stimulate the ULF waves by injecting pulses of VLF waves into the magnetosphere. A second possible method of ULF wave generation, the peninsula method, is discussed in a companion report. Combining the theoretical and experimental results obtained during this research, it is suggested that naturally-occurring repetitive VLF activity can stimulate Pc 1 pulsation events, and it is further suggested that such VLF activity may be a major source of stimulation for Pc 1 pulsations. Thus, future experiments on ULF wave generation with ground-based VLF transmitters would probably benefit greatly if they were combined with a program of simultaneous observations of naturally-occurring VLF and ULF activity.

8697 **(AD-A—131793/2) Magnetospheric plasma studies using data from the Dynamics high and low altitude plasma instruments. Technical report.** Barfield, J.N. (Southwest Research Inst., San Antonio, TX (USA)). 15 May 1983. 52p. (SCIENTIFIC—1). NTIS, PC A04/MF A01.

Plasma data from the High and Low Altitude Plasma Instruments aboard the Dynamics 1 and 2 (DE-1 and DE-2) satellites have been analyzed to investigate high latitude plasma characteristics. DE-1 hot plasma observations in the mid-altitude polar cusp have shown evidence of a significant velocity filtering phenomenon which is consistent with a latitudinally narrow region of plasma injection located at a geocentric distance of about 8 earth radii (RE). This velocity filtering effect allows the measurement of much smaller flow velocities (about km/s) than have heretofore been possible with plasma measurements. Observations at altitudes of 2-3 RE indicate two distinct types of counterstreaming electron events. The type 1 event is characterized by two Maxwellian distribution functions, an isotropic high-temperature component and a field-aligned low temperature component. Type 1 events appear to involve wave-particle interactions while type 2 events imply direct acceleration by oppositely-directed electric fields pointing toward the satellite along magnetic field lines. The data indicate that cold ionospheric electrons, which carry the downward region-1 Birkeland currents on the morning side, are accelerated upward by potential drops of tens of eV at altitudes of several thousand kilometers. This acceleration process allows spacecraft above those altitudes to measure routinely the charge carriers of both downward and upward current systems.

8698 **(AD-A—131946/6) Beam plasma turbulence study. Final report 1 Aug 79-30 Sep 82.** Chang, T.; Coppi, B. (Massachusetts Inst. of Tech., Cambridge (USA). Center for Space Research). 1 May 1983. 83p. NTIS, PC A05/MF A01.

We are concerned with the plasma wave radiations and turbulence, generated by natural or artificially produced charged beams and currents or plasma anisotropy, in the Earth's ionosphere and magnetosphere--particularly in the topside ionosphere and the suprauroral region. Specific problems studied during the three-year contract period include: ion conics and beams, lower hybrid waves and hybrid whistlers, nonlinear electrostatic ion cyclotron waves and cavitations, the beam-plasma-discharge phenomenon, strong plasma turbulence, electrostatic shocks across auroral field lines, particle-acceleration mechanisms, collisional effects, and anisotropy-driven magnetic reconnection processes. Major research contributions are described in detail in this report. Complete lists of the titles of scientific publications and technical professional and technical presentations sponsored by this contract are also given, and important related professional activities are outlined.

8699 **(AD-A—132017/5) Preliminary data processing plan for the thermal plasma experiment on the HILAT satellite. Instrumentation papers.** Rich, F.J.; Heelis, R.A. (Air Force Geophysics Lab., Hanscom AFB, MA (USA)). 31 Mar 1983. 43p. NTIS, PC A03/MF A01.

The thermal plasma experiment is one of five experiments to be flown on the HILAT satellite in a polar orbit. The experiment consists of an ion drift-meter, an ion retarding potential analyzers and a spherical electron Langmuir probe. The details of the instruments are described. The calibrations and conversion factor to change from telemetry units to scientific units are given. Algorithms for converting the raw data into the parameters of interest are given. These algorithms are intended for obtaining quick-look information. Refinements to the algorithm will be required before the final results are released.

8700 **(LA-UR—83-3361) Plasma sheet behavior during substorms.** Hones, E.W. Jr. (Los Alamos National Lab., NM (USA)). 1983. Contract W-7405-ENG-36. 30p. (CONF-8310229—5). NTIS, PC A03/MF A01. Order Number DE84003833.

From Chapman conference on magnetic reconnection; Los Alamos, NM, USA (3 Oct 1983).

Auroral or magnetic substorms are periods of enhanced auroral and geomagnetic activity lasting one to a few hours that signify increased dissipation of energy from the magnetosphere to the earth. Data acquired during the past decade from satellites in the near-earth sector of the magnetotail have suggested that during a substorm part of the plasma sheet is severed from earth by magnetic reconnection, forming a plasmoid, i.e., a body of plasma and closed magnetic loops, that flows out of the tail into the solar wind, thus returning plasma and energy that have earlier been accumulated from the solar wind. Very recently this picture has been dramatically confirmed by observations, with the ISEE 3 spacecraft in the magnetotail 220 R/sub E/ from earth, of plasmoids passing that location in clear delayed response to substorms. It now appears that plasmoid release is a fundamental process whereby the magnetosphere gives up excess stored energy and plasma, much like comets are seen to do, and that the phenomena of the substorm seen at earth are a by-product of that fundamental process.

8701 **(LA-UR—83-3368) Review of radio-frequency, nonlinear effects on the ionosphere.** Gordon, W.E.; Duncan, L.M. (Rice Univ., Houston, TX (USA); Los Alamos National Lab., NM (USA)). 1983. Contract W-7405-ENG-36. 13p. (CONF-830972—1). NTIS, PC A02/MF A01. Order Number DE84003832.

From 20. congress of the International Association of Hydraulic Research; Moscow, USSR (5 Sep 1983).

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Modification of the ionosphere by high power radio waves in the megahertz band has been intensively investigated over the past two decades. This research has yielded advances in aeronomy, geophysics, and plasma physics with applications to radio communication and has provided a fruitful interaction of radio theorists and experimentalists. There being almost no linear effects of powerful radio waves on the ionosphere, we concentrate on the nonlinear effects. To put the subject in perspective we trace its history beginning in the early 1930s and highlight the important events up to the late 1960s. We then shift to a phenomenological approach and deal in order with ohmic heating, parametric instabilities, self-focusing and kilometer-scale irregularities, meter-scale irregularities, and a collection of recently discovered effects. We conclude with the observation that stronger international cooperation would benefit this research, and describe a list of promising, difficult challenges.

8702 **(LA-UR—83-3498) Implications of the 1100 UT March 22, 1979 CDAW 6 substorm event for the role of magnetic reconnection in the geomagnetic tail.** Fritz, T.A.; Baker, D.N.; McPherron, R.L.; Lennartsson, W. (Los Alamos National Lab., NM (USA); California Univ., Los Angeles (USA). Inst. of Geophysics and Planetary Physics; Lockheed Palo Alto Research Labs., CA (USA)). 1983. Contract W-7405-ENG-36. 18p. (CONF-8310229—1). NTIS, PC A02/MF A01. Order Number DE84004335.

From Chapman conference on magnetic reconnection; Los Alamos, NM, USA (3 Oct 1983).

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The event of March 22, 1979 has been the object of a concentrated study effort as a part of the Coordinated Data Analysis Workshop activity designated CDAW-6. Energetic electron and magnetic field measurements from a set of four satellites aligned from 6.6 to 13 R/sub E/ at the 0200 LT meridian at the time of the magnetospheric substorm event of 1100 UT are presented. These data are used to show that a magnetic X-line formed spontaneously in the vicinity of 7 R/sub E/ in response to a steady build-up of magnetic stress in the geomagnetic tail.

6403 Atomic, Molecular, And Chemical Physics

REFER ALSO TO CITATION(S) 8007, 8358, 8836, 8989, 9046, 9087

8703 **(AD-A—131148/9) Ion-ion recombination rate in the EMP source region. Technical report.** Chervenak, J.G.; van Lint, V.A.J. (Mission Research Corp., Santa Barbara, CA (USA)). 10 Feb 1982. 32p. (MRC/SD-R—98). NTIS, PC A03/MF A01.

The ion-ion recombination coefficient in air was measured to be 7.0 + or - 0.4 x 10^7 power cu cm/s using an ion chamber at HIFX. The difference between this and previously measured values may be due to air purity or a dose dependence.

8704 **(CONF-830390—2) Progress in numerical calculations of ion-atom collisions.** Reading, J.F.; Ford, A.L.; Becker, R.L. (Texas A and M Univ., College Station (USA). Dept. of Physics; Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 5p. NTIS, PC A02/MF A01. Order Number DE84003405.

From US/Japanese seminar on physics of highly ionized ions produced in heavy ion collisions; Honolulu, HI, USA (14 Mar 1983).

An ion-atom collision produces a time dependent perturbation of a many fermion system. In this collision, excitation, ionization and charge transfer can occur. The driving mechanism for these processes may be thought of as the potentials seen by individual electrons at any given separation of the projectile and target nuclei. If we think of these potentials as belonging to the target (a nucleus and electrons) and the projectile (another nucleus and electrons) then as detected by an electron the potentials change because: (a) the target and projectile change position, and (b) electrons on the target and projectile change states. Most work in the past fifty years has concentrated on solving the independent particle model (IPM). Cracks are beginning to appear in this model which only allows for type (a) changes in the potential. But in a short review we shall have quite enough to do in understanding the progress made in the last decade on the IPM. This paper is divided into three parts. The first deals with how to reduce the IPM to the single electron model (SEM). The second is on a new method where charge transfer is important. The third confronts some standard models with modern calculations.

8705 **(DOE/ER/02408—214) Energetic ion-atom collisions: early beginnings and recent advances.** Merzbacher, E. (North Carolina Univ., Chapel Hill (USA). Dept. of Physics and Astronomy). 1983. Contract AS05-76ER02408. 29p. (ORO—2408-214; CONF-830706—9). NTIS, PC A03/MF A01. Order Number DE84004052.

From 13. international conference on the physics of electronic and atomic collisions (ICPEAC); Berlin, F.R. Germany (27 Jul 1983).

From the discovery of canal rays and radioactivity to the invention of accelerators and the first applications of the Born approximation, some developments which were seminal for the development of ion-atom collisions are described. Collision theory is shown to have played a key role in the evolution of the early quantum theory and of quantum mechanics and its probability interpretation.

8706 **(DOE/ER/10375—3) Study of the motion of electrons in non-polar classical liquids. Progress report.** Ascarelli, G. (Purdue Univ., Lafayette, IN (USA). Dept. of Physics). 1983. Contract AC02-79ER10375. 6p. NTIS, PC A02/MF A01. Order Number DE84004267.

Research is reported on electron mobility in organic liquids, Hall mobility of electrons injected in liquid argon, photoconductivity of trapped electrons in argon, and magneto-photoemission into rare gases. (GHT)

8707 **(DOE/ER/40001—36) Production of polarized negative ion beams by collisional pumping.** Anderson, L.W.; Kaplan, S.N.; Pyle, R.V.; Ruby, L.; Schlachter, A.S.; Stearns, J.W. (Wisconsin Univ., Madison (USA); Lawrence Berkeley Lab., CA (USA)). 1983. Contract AC02-81ER40001. 10p. (CONF-831180—10). NTIS, PC A02/MF A01. Order Number DE84004836.

From 3. international symposium on the production and neutralization of negative ions and beams; Upton, NY, USA (14 Nov 1983).

The production of polarized negative ion beams by collisional pumping is described. Collisional pumping utilizes repeated charge changing collisions in a thick electron-spin-polarized gas or vapor target to form a polarized fast atom beam. The polarized fast atom beam is then partially converted into a polarized negative ion beam in a vapor target. Analysis is presented for a hydrogen beam passing through either a thick polarized H atom target or a thick polarized alkali target. Large polarizations and large currents may be possible.

8708 **(FRNC-TH—1194) Measurement of the ortho-para transition rate in the pμp molecule. Discussion on the measurements of μ^- capture rates on protons and study of the pseudoscalar coupling constant Fsub(p)sup(μ).** Bardin, G. (Paris-11 Univ., 91 - Orsay (France)). Oct 1982. 160p. (In French). NTIS (US Sales Only), PC A08/MF A01. Order Number DE84750224.

The first measurement of the transition rate lambdasub(0P)between the ortho and para states of the pμp molecule is presented. This rate is deduced from the time distribution of the 5.2 MeV neutrons due to the capture $\mu p \rightarrow n\nu$sub(μ). The experiment needs mainly: 1) a liquid hydrogen target of very high purity (level of impurities $< 10^{-9}$); 2) a high neutron-gamma rejection power (10^{-8}), achieved by shape analysis of the pulse from the neutron detectors in order to eliminate the bremsstrahlung photons of decay electrons $\mu \rightarrow e\nu\nu$; 3) background neutron substraction, identified either by their energy or time dependence or by specific measurements.

8709 **(INIS-mf—8656) Neutron energy spectra produced by α-bombardment of light elements in thick targets.** Jacobs, G.J.H. (Technische Hogeschool Eindhoven (Netherlands)). 1 Oct 1982. 131p. NTIS (US Sales Only), PC A07/MF A01. Order Number DE83704742.

The aim of the work, presented in this thesis, is to determine energy spectra of neutrons produced by α-particle bombardment of thick targets containing light elements. These spectra are required for nuclear waste management. The set-up of the neutron spectrometer is described, and its calibration discussed. Absolute efficiencies were determined at various neutron energies, using monoenergetic neutrons produced with the Van de Graaff accelerator in pulsed mode. The additional calibration of the neutron spectrometer as proton-recoil spectrometer was carried out primarily for future applications in measurements where no pulsed neutron source is available or the neutron flux density is too low. The basis for an accurate uncertainty analysis is made by the determination of the covariance matrix for the uncertainties in the efficiencies. The determination of the neutron energy spectra from time-of-flight and from proton-recoil measurements is described. A comparison of the results obtained from the two different types of measurements is made. The experimentally determined spectra were compared with spectra calculated from stopping powers and theoretically determined cross sections. These cross sections were calculated from optical model parameters and level parameters using the Hauser-Feshbach formalism. Measurements were carried out on thick targets of

silicon, aluminium, magnesium, carbon, boron nitride, calcium fluoride, aluminium oxide, silicon oxide and uranium oxide at four different α-particle energies.

8710 (INIS-mf—8664, pp 50) **Fraction determinations for long-lived states in ion beams.** Hofer, W.; Vanek, W.; Varga, P.; Winter, H. (Technische Univ., Vienna (Austria). Inst. fuer Allgemeine Physik). 1982. (In German). NTIS (US Sales Only), PC A05/MF A01. (CONF-8209185—).

From Annual conference of the Austrian Physical Society; Graz, Austria (22 Sep 1982).

Published in summary form only.

8711 (INIS-mf—8664, pp 50) **Far ultraviolet-spectroscopic investigations on long-lived ion excitation states.** Brazuk, A.; Winter, H. (Technische Univ., Vienna (Austria). Inst. fuer Allgemeine Physik). 1982. (In German). NTIS (US Sales Only), PC A05/MF A01. (CONF-8209185—).

From Annual conference of the Austrian Physical Society; Graz, Austria (22 Sep 1982).

Published in summary form only.

8712 (INIS-mf—8664, pp 33) **Positron lifetime investigations in Cd and In.** Puff, W.; Mascher, P.; Kindl, P.; Sormann, H. (Technische Univ., Graz (Austria). Inst. fuer Kernphysik). 1982. (In German). NTIS (US Sales Only), PC A05/MF A01. (CONF-8209185—).

From Annual conference of the Austrian Physical Society; Graz, Austria (22 Sep 1982).

Published in summary form only.

8713 (INIS-mf—8664, pp 33) **Positron lifetime investigations on polytetrafluorethylenes (PTFE) as function of temperature and crystallinity.** Kindl, P.; Sormann, H.; Puff, W. (Graz Univ. (Austria)). 1982. (In German). NTIS (US Sales Only), PC A05/MF A01. (CONF-8209185—).

From Annual conference of the Austrian Physical Society; Graz, Austria (22 Sep 1982).

Published in summary form only.

8714 (JINR-D—1,2-82-27, pp 234-237) **DeVelopment of the high-intensity polarized H^- source with proton charge exchange on sodium optically oriented atoms.** Zelenskij, A.N.; Kokhanovskij, S.A. (AN SSSR, Moscow. Inst. Yadernykh Issledovanij). 1982. (In Russian). NTIS (US Sales Only), PC A15/MF A01. (CONF-811147—).

From International symposium on polarization phenomena at high energies; Dubna, USSR (17 Nov 1981).

The results of experimental study on the source of polarized H^- ions at polarized electron capture by proton from optically oriented sodium atoms are presented. Circular-polarized dye laser radiation with lamp pumping is used for polarization of highly dense sodium vapors in the pulsed mode. A facility for polarization measurement in the ion source is described. Dependence of the counting rate of metastables for the right and left circular radiation polarization in respect to wave length is presented. The results of measuring the degree of polarization under change of sodium density are revealed. The measurements have disclosed that obtaining of high polarization degree at 20-30% charge exchange effectiveness is possible but large radiation power is required. Use of a dense charge exchange target provides high effectiveness of the whole polarization process. Yield of polarized H^- ions can approach 10 μA/1 mA of the initial proton current.

8715 (JINR-D—1,2-82-27, pp 238-240) **Possibility of accelerated proton polarization by laser radiation.** Zelenskij, A.N.; Kohanovskij, S.A. (AN SSSR, Moscow. Inst. Yadernykh Issledovanij). 1982. (In Russian). NTIS (US Sales Only), PC A15/MF A01. (CONF-811147—).

From International symposium on polarization phenomena at high energies; Dubna, USSR (17 Nov 1981).

A block diagram of laser polarizer of fast neutrals for polarized proton production is suggested. Fast neutrals are produced under stripping of negative hydrogen ions with laser radiation. Further on the neutrals are converted in the charge exchange cell into polarized protons. It is shown that industrial lasers on dyes with lamp pumping permit to obtain the necessary power of approximately 10^6 W at approximately 1 μs radiation pulse duration with 10 Hz repetition frequency. Polarized proton current of approximately 50 μA can be obtained in every accelerator pulse during 1 μs using several lasers. Realization of the fast neutral laser polarization method reveals new prospects for polarization investigations in "meson factory".

8716 (LA-UR—83-3713) **Line width and line shape analysis in the inductively coupled plasma by high resolution Fourier transform spectrometry.** Faires, L.M.; Palmer, B.A.; Brault, J.W. (Los Alamos National Lab., NM (USA); National Solar Observatory, Tucson, AZ (USA)). 1984. Contract W-7405-ENG-36. 37p. (CONF-840101—1). NTIS, PC A03/MF A01. Order Number DE84004358.

From Winter conference on plasma spectrochemistry; San Diego, CA, USA (2 Jan 1984).

Portions are illegible in microfiche products.

High resolution Fourier transform spectrometry has been used to perform line width and line shape analysis of eighty-one iron I emision lines in the spectral range 290 to 390nm originating in the normal analytical zone of an inductively coupled plasma. Computer programs using non-linear least squares fitting techniques for line shape analysis were applied to the fully resolved spectra to determine Gaussian and Lorentzian components of the total observed line width. The effect of noise in the spectrum on the precision of the line fitting technique was assessed, and the importance of signal to noise ratio for line shape analysis is discussed. Translational (Doppler) temperatures were calculated from the Gaussian components of the line width and were found to be on the order of 6300°K. The excitation temperature of iron I was also determined from the same spectral data by the spectroscopic slope method based on the Einstein-Boltzmann expression for spectral intensity and was found to be on the order of 4700°K. 31 references.

8717 (LBL—16892) **Auger decay mechanism in photon-stimulated desorption of ions from surfaces.** Parks, C.C. (Lawrence Berkeley Lab., CA (USA)). Nov 1983. Contract AC03-76SF00098. 156p. NTIS, PC A08/MF A01. Order Number DE84004351.

Thesis.

Photon-stimulated desorption (PSD) of positive ions was studied with synchrotron radiation using an angle-integrating time-of-flight mass spectrometer. Ion yields as functions of photon energy near core levels were measured from condensed gases, alkali fluorides, and other alkali and alkaline earth halides. These results are compared to bulk photoabsorption measurements with emphasis on understanding fundamental desorption mechanisms. The applicability of the Auger decay mechanism, in which ion desorption is strictly proportional to surface absorption, is discussed in detail. The Auger decay model is developed in detail to describe Na^+ and F^+ desorption from NaF following Na(1s) excitation. The major decay pathways of the Na(1s) hole leading to desorption are described and equations for the energetics of ion desorption are developed. Ion desorption spectra of H^+, Li^+, and F^+ are compared to bulk photoabsorption near the F(2s) and Li(1s) edges of LiF. A strong photon beam exposure dependence of ion yields from alkali fluorides is revealed, which may indicate the predominance of metal ion desorption from defect sites. The large role of indirect mechanisms in ion desorption condensed N_2-O_2 multilayers is demonstrated and discussed. Ion desorption spectra from several alkali halides and alkaline earth halides are compared to bulk photoabsorption spectra. Relative ion yields from BaF_2 and a series of alkali halides are discussed in terms of desorption mechanisms.

8718 **Picosecond studies of the temperature dependence of homogeneous and inhomogeneous vibrational linewidth broadening in liquid acetonitrile.** George, S.M.; Harris, A.L.; Berg, M.; Harris, C.B. (Department of Chemistry and Materials and Molecular Research Division of Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Journal of Chemical Physics;* **80**: No. 1, 83-94(1 Jan 1984).

The temperature dependence of homogeneous and inhomogeneous vibrational linewidth broadening is reported for the symmetric CH_3-stretching vibration in acetonitrile over its entire liquid

range at P = 1 atm. A selective excite-and-probe vibrational dephasing experiment based on transient stimulated Raman scattering in high laser depletion is used to measure the homogeneous dephasing times T_2. The separation of homogeneous and inhomogeneous broadening processes is accomplished using the combined results of isotropic spontaneous Raman studies and selective picosecond vibrational dephasing experiments. As a function of temperature, the relative contributions of homogeneous and inhomogeneous broadening are shown to change significantly in opposing directions. Agreement between experiment and theory supports previous suggestions that homogeneous broadening is caused by rapidly varying processes which affect the vibration via short range repulsive forces. The results also suggest that inhomogeneous broadening is caused by slowly varying local density sites which interact with the vibration through long range attractive forces.

8719 **Electron spectroscopy of hydrogen chloride from 5 to 19 eV.** Wang, R.; Dillon, M.A.; Spence, D. (Argonne National Laboratory, Argonne, Illinois 60439). *Journal of Chemical Physics;* **80**: No. 1, 63-69(1 Jan 1984). Contract W-31-109-ENG-38.

Using an electron energy loss spectrometer, we have measured the spectra of electrons inelastically scattered from HCl for an incident electron energy of 200 eV, energy loss between 5 and 19 eV, and scattering angles of 0° to 19°. The low-angle scattering spectra, corresponding to photoabsorption, confirm many optically allowed energy levels in HCl, and locate many others, including six levels of the $\sigma^2\pi^3 ns\sigma$ ^{1}Pi Rydberg series. Series analysis yields an HCl ionization potential of 12.790 eV, midway between the known HCl^+ ^{2}Pi/sub 3/2,ts1/2/ energies 12.750 and 12.830 eV. In the ionization continuum, we locate a new vibrational progression associated with previously observed (negative ion) Feshbach resonances, which has configuration $3p\sigma 3p\pi^4 4s\sigma$, and is the lowest Rydberg state associated with the first excited ionic state A $^2\Sigma^+$.

8720 **HO^+Z molecular ion. Geometrical structure and vibrational frequencies.** Raine, G.P.; Schaefer, H.F. III; Handy, N.C. (Department of Chemistry and Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Journal of Chemical Physics;* **80**: No. 1, 319-324(1 Jan 1984).

The equilibrium geometry and harmonic vibrational frequencies of HO^+_2 have been predicted at seven distinct levels of ab initio theory. In this regard, self-consistent-field (SCF) and configuration interaction (CI) methods were used in conjunction with double zeta (DZ), double zeta plus polarization (DZ+P), and extended basis sets of contracted Gaussian functions. The molecular structure of HO^+_2 predicted at the DZ+P CI level of theory is r/sub e/(H—O) = 1.005 A, r/sub e/(O—O) = 1.239 A, θ/sub e/(HOO) = 111.5°, compared to the experimental structure of neutral HO_2, r_0(H—O) = 0.977 A, r_0(O—O) = 1.334 A, θ_0(HOO) = 104.2°. Anharmonic vibrational frequencies were also predicted at four different levels of theory, with the DZ+P CI results being ν_1 = 3204 cm^{-1}, ν_2 = 1572 cm^{-1}, ν_3 = 1144 cm^{-1}. For comparison, the observed fundamentals for the neutral HO_2 molecule are ν_1 = 3436 cm^{-1}, ν_2 = 1392 cm^{-1}, and ν_3 = 1098 cm^{-1}.

8721 **Electronic symmetry breaking in polyatomic molecules. Multiconfiguration self-consistent field study of the cyclopropenyl radical C_3H_3.** Hoffmann, M.R.; Laidig, W.D.; Kim, K.S.; Fox, D.J.; Schaefer, H.F. III. (Department of Chemistry and Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Journal of Chemical Physics;* **80**: No. 1, 338-343(1 Jan 1984).

For equilateral triangle geometries (point group D/sub 3h/), the C_3H_3 radical has a degenerate $^2E'$ electronic ground state. Although the $^2A_2$ and $^2B_1$ components separate in energy for C/sub 2v/ geometries, these two components should have identical energies for equilateral triangle structures. In fact, when approximate wave functions are used and the orbitals not required to transform according to the D/sub 3h/ irreducible representations, an energy separation between the $^2A_2$ and $^2B_1$ components is observed. At the single configuration self-consistent field (SCF) level of theory this separation is 2.8 kcal with a double-zeta basis set and 2.4 kcal with double-zeta plus polarization. It has been demonstrated that this spurious separation may be greatly reduced using multiconfiguration self-consistent field (up to 7474 variationally optimum configurations) and configuration interaction (up to 60 685 space and spin adapted configurations) techniques. Configurations differing by three and four electrons from the Hartree—Fock reference function are found necessary to reduce the $^2A_2$-$^2B_1$ separation to below 0.5 kcal.

8722 **Kinematic apse and j/sub z/-preserving propensities for nonreactive, dissociative, and reactive polyatomic collisions.** Hoffman, D.K.; Evans, J.W.; Kouri, D.J. (Ames Laboratory, USDOE, and Department of Chemistry, Iowa State University, Ames, Iowa 50011). *Journal of Chemical Physics;* **80**: No. 1, 144-148(1 Jan 1984).

We consider the generalization of the kinematic apse to nonreactive polyatom—polyatom impulsive collisions, dissociative atom—molecule impulsive collisions, and (partially) impulsive reactive atom—diatom collisions. Appropriate generalizations of the kinematic apse are obtained along which there is a classical propensity for preserving the projection of the total intrinsic spin. In the case of reactive scattering, we discuss several different situations for which such a propensity occurs. For reactive systems in which no such propensity exists, the analysis may still provide a basis for classifying reactions.

8723 **Local electron flow to the anode in a magnetically insulated diode.** Maron, Y. (Laboratory of Plasma Studies, Cornell University, Ithaca, New York 14853). *Physics of Fluids;* **27**: No. 1, 285-290(Jan 1984). Contract AS08-81DP40139.

Local electron flux to the anode of a magnetically insulated diode is monitored. Intense electron burst to the anode and slow variations in the electron flux are observed. Unlike the slow signals the bursts are accompanied by sharp increases in microwave emission and by increases in the ion current density. The electron bursts are not affected by the presence of the anode plasma. Indications suggest that the bursts are initiated by processes in the cathode plasma.

8724 **Cesiated porous molybdenum converter for intense negative ion sources.** Alessi, J.G.; Hershcovitch, A.; Sluyters, T. (Brookhaven National Laboratory, Upton, New York 11973). *Review of Scientific Instruments;* **55**: No. 1, 8-11(Jan 1984).

Maintaining the proper low work function surface in steady-state high-current-density negative ion sources is difficult, due to intense ion bombardment of the surface. Experiments were performed in which liquid cesium was forced through a porous molybdenum converter in order to obtain a low work function, while at the same time allowing the surface to be cooled. In a small steady-state hollow cathode discharge source, the H^- yield from a porous molybdenum converter was five fold higher than from a solid molybdenum converter which relied on the conventional method of cesium coverage by vapor deposition.

8725 **Simple, compact, medium-energy Mott polarization analyzer.** Gray, L.G.; Hart, M.W.; Dunning, F.B.; Walters, G.K. (Department of Physics and the Rice Quantum Institute, Rice University, Houston, Texas 77251). *Review of Scientific Instruments;* **55**: No. 1, 88-91(Jan 1984).

A simple, compact, UHV compatible Mott polarization analyzer is described that employs electron accelerating voltages in the range 20—40 keV. The analyzer provides excellent discrimination against inelastically scattered electrons and has the advantage that the major portion of the apparatus, and the scattered electron detectors, are operated near ground potential. The efficiency of the analyzer, $\sim 2 \times 10^{-5}$, is competitive with those provided by other polarimeters. The analyzer can measure the polarization of electron beams having currents as low as $\sim 10^{-13}$ A and is suitable for use in a wide variety of experiments involving polarized electron beams.

8726 **Charge transfer to multicharged recoil ions in a Penning trap.** Church, D.A.; Kenefick, R.A.; Burns, W.S.; Holmes, C.S.O.R.; Huldt, S.; Berry, S.; Breinig, M.; Elston, S.; Rozet, J.; Sellin, I.A. (Physics Department, Texas A & M University, College Station, Texas 77843). *Physical Review Letters;* **51**: No. 18, 1636-1639(31 Oct 1983). Contract W-7405-ENG-26.

Multicharged neon recoil ions at electronvolt energies are produced inside a Penning ion trap by fast, stripped—heavy-ion impact on neon atoms. The stored recoil ions capture electrons in collisions with the parent neon gas. The measured storage times are used with mean energy determinations and neon gas densities to determine charge-transfer rate coefficient. A significant dependence on ion charge ($3< or =q< or =6$) is observed.

8727 **Electron scattering by highly polar molecules: A benchmark experiment.** Jaduszliwer, B.; Tino, A.; Weiss, P.; Bederson, B. (Department of Physics, New York University, New York, New York 10003). *Physical Review Letters;* **51**: No. 18, 1644-1647(31 Oct 1983).

Absolute measurements of an integral of the differential cross section for the scattering of electrons by CsBr are reported in the 1—22.5-eV energy range. A precise prescription for comparison with theory is presented, thus setting a benchmark for testing calculations. Comparison with Born-approximation calculations is also presented.

8728 **Cross sections for electron ionization of triply charged noble gases in the plane-wave Born approximation.** McGuire, E.J. (Sandia National Laboratories, Division 1231, P.O. Box 5800, Albuquerque, New Mexico 87185). *Physical Review [Section] A: General Physics;* **28**: No. 4, 2091-2095(Oct 1983).

Plane-wave Born-approximation calculations are presented for electron ionization of triply ionized noble-gas ions, and compared with recent experiment. Excellent agreement with experiment is found for Ne^{3+}, Ar^{3+}, and Kr^{3+}. The calculated cross section for ionization of Xe^{3+} is larger than the measurement by almost a factor of 2. The discrepancy is entirely due to the large cross section for excitation of the $(4d)^{10}\rightarrow(4d)^9(4f)$ transition followed by autoionization. It is suggested that configuration interaction will redistribute this transition with some strength transferred to exciting bound levels.

8729 **Surface spectroscopy using high energy heavy ions.** Doyle, B.L.; Cocke, C.L.; Gray, T.J.; Justiniano, E.; Peercy, P.S. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **30**: No. 2, 1252-1254(Apr 1983). Contract AC04-76DP00789.

Surface atoms ionized by high energy heavy ions have been detected by time-of-flight and quadrupole mass spectroscopic techniques. The experimental arrangements are described and potential applications are suggested. Both techniques are demonstrated to produce significant improvements in the detection of atomic hydrogen, with the TOF method producing a nine order of magnitude increase in the sensitivity of atomic hydrogen compared to standard nuclear analysis methods.

8730 **$Z_1 3$, $Z_1 4$ corrections to heavy ion energy loss.** Anthony, J.M.; Lanford, W.A.; Parker, P.D. (Yale University, New Haven, Connecticut 06511). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 2, 1227-1229(Apr 1981). (CONF-801111—).

From 6. conference on application of accelerators in research and industry; Denton, TX, USA (3 Nov 1980).

The authors have measured the energy loss of several heavy ions (Z_1 = 6, 14, 17, 22, 26, 28, 32, 35, 41 and 53) in elemental targets (Z_2 = 6, 13, 29, 47 and 79) at energies near the stopping power maximum. The results are not well described by current compilations, which are based on a Z_1^2 stopping power dependence. Use of higher order Z_1 corrections to the stopping power, however, in conjunction with simple effective charge expressions, allows reasonable fits to the data to be made.

8731 **Enhanced backscattering near 180° for energetic ions in solids.** Holland, O.W.; Appleton, B.R.; Barrett, J.H. (Oak Ridge National Lab., Oak Ridge, Tennessee 37830). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 2, 1824-1827(Apr 1981). (CONF-801111—).

From 6. conference on application of accelerators in research and industry; Denton, TX, USA (3 Nov 1980).

A new ion scattering effect which enhances backscattering yields near 180° has been recently reported. A computer program which simulates this scattering effect is discussed and the results compared with measurements. Both the angular distribution and depth profiles of the backscattered yield enhancements are compared. These comparisons verify the proposed explanation for the new scattering phenomena and a tentative explanation is offered for the small discrepancies which exist.

8732 **The measurement of lithium hydride enrichment.** Cochran, J.L.; Hill, J.T. (Union Carbide Corp, Nuclear Div., Oak Ridge Y-12 Plant, P.O. Box Y, Oak Ridge, TN 37830). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 2, 1855-1857(Apr 1981). (CONF-801111—).

From 6. conference on application of accelerators in research and industry; Denton, TX, USA (3 Nov 1980).

Deuterons produced by a 2.5 MV Van de Graaff accelerator are used to measure the isotopic ratios of ^{6}Li to ^{7}Li and H to D in lithium hydride. Using corrections for oxygen on the surface, ^{6}Li enrichments accurate to 0.36 atom percent and D enrichments accurate to 2.1 atom percent were obtained.

8733 **Classical generalized transition-state theory. Application to a collinear reaction with two saddle points.** Garrett, B.C.; Truhlar, D.G.; Grev, R.S. (Univ. of Minnesota, Minneapolis). *Journal of Physical Chemistry;* **85**: No. 11, 1569-1572(1981). Contract AC02-79ER10425.

Accurate classical dynamical fixed-energy reaction probabilities and fixed-temperature rate constants are calculated for the collinear reaction H + FH on a low-barrier model potential energy surface. The calculations cover energies from 0.1 to 100 kcal/mol above threshold and temperatures of 100 to 10,000 K. The accurate results are used to test five approximate theories: conventional transition-state theory (TST), canonical variational theory (CVT), improved canonical variational theory (ICVT), microcanonical variational theory (μVT), and the unified statistical model (US). The first four of these theories involve a single dividing surface in phase space, and the US theory involves three dividing surfaces. The tests are particularly interesting because the potential energy surface has two identical saddle points. At temperatures from 100 to 2000 K, the μVt is the most accurate theory, with errors in the range 11 to 14%; for temperatures from 2000 to 10,000 K, the US theory is the most successful, with errors in the range 3 to 14%. Over the whole range, a factor of 100 in temperature, both theories have errors of 35% or less. Even TST has errors of 47% or less over the whole factor-of-100 temperature range. Although the US model should become exact at threshold for this system, it already underestimates the reaction probability by a factor of 0.64 at 0.1 kcal/mol above threshold. TST and μVT agree with each other within 12% up to an energy 13 kcal/mol above the saddle point energy. 3 figures, 2 tables.

6404 Fluid Physics

REFER ALSO TO CITATION(S) 7739, 9062, 9108

8734 **(K/CSD—18) Finite element simulation of viscous incompressible flows.** Becker, B.R.; Drake, J.B.; Bass, B.R. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). Nov 1983. Contract W-7405-ENG-26. 70p. NTIS, PC A04/MF A01. Order Number DE84004355.

The Galerkin-finite element approximation to the Navier-Stokes equations is developed from the continuous conservation laws governing the time-dependent flow of a viscous incompressible fluid. A computer code implementing the approach is described and results from several example problems are discussed. Biquadra-

tic Lagrangian isoparametric elements are used to discretize the velocities. Bilinear elements discretize the pressure unknown. The nonlinear problem that results from the convection term in the Navier-Stokes equations is solved using a Picard iteration for the correct velocity and pressure fields. The stiffness matrix is factored at each step of the iteration using a frontal solution technique. Results from both steady-state and time-dependent convection dominated flows are given. Extensive appendixes accompany the report including all the details necessary to develop a finite element code.

8735 **(LBL—16702) Vortex methods for flows of variable density.** Anderson, C.R. (Lawrence Berkeley Lab., CA (USA)). Jun 1983. Contract AC03-76SF00098. 166p. NTIS, PC A08/MF A01. Order Number DE84002915.

Thesis.

We present two numerical methods for calculating the motion of an incompressible, inviscid fluid of slightly varying density. The methods, both based on the vortex method developed by Chorin, are grid free and have no intrinsic source of numerical diffusion. We analyze the methods using techniques derived from the recent work on the convergence of the vortex method. We prove a convergence result for one method and prove a partial convergence result for the other method. We present an exact solution to the equations of motion for a fluid of variable density and use this solution to test both numerical methods. The test results indicate that the methods are stable and accurate. An application to the problem of calculating the motion of a 2-D thermal is also presented. The computational results indicate that the methods are suitable for calculating flows associated with thermal convection phenomena. In the course of our investigations of the motion of a 2-D thermal, we found significant computational evidence to suggest that a singularity develops in the flow in finite time. This singularity appears to be confined to a small set, possibly a point, and is characterized by an infinite value of vorticity there.

8736 **Comment on the order of the wetting transition at a solid—fluid interface.** Evans, R.; Tarazona, P. (H. H. Wills Physics Laboratory, University of Bristol, Bristol BS8 ITL, United Kingdom). *Journal of Chemical Physics;* **80**: No. 1, 587-589(1 Jan 1984).

We have repeated calculations of Teletzke et al. which describe the wetting transition at some models of a solid—gas interface. Our numerical results differ significantly from theirs in several cases. Contrary to Teletzke et al. we find that this transition is always first order for a Lennard-Jones 9-3 substrate potential when the van der Waals integral theory is employed.

8737 **Reply to " A Comment on the order of the wetting transition at a solid—fluid interface".** Benner, R.E. Jr.; Teletzke, G.F.; Scriven, L.E.; Davis, H.T. (Department of Chemical Engineering and Materials Science, University of Minnesota, Minneapolis, Minnesota 55455). *Journal of Chemical Physics;* **80**: No. 1, 589-590(1 Jan 1984).

Evans and Tarazona have raised a disagreement with the results of Teletzke et al. concerning wetting transitions predicted by van der Waals' integral theory with exponential fluid potential and two different fluid-solid potentials. We reexamined these results and in agreement with Evans and Tarazona we conclude that the wetting transition is first order when a Lennard-Jones 9-3 fluid—solid potential is chosen. The results are supported by the predictions of a simple model, a discontinuous thick film.

8738 **Formation and expansion of a toroidal drop moving in a viscous fluid.** Kojima, M.; Hinch, E.J.; Acrivos, A. (Department of Chemical Engineering, Stanford University, Stanford, California 94305). *Physics of Fluids;* **27**: No. 1, 19-32(Jan 1984). Contract AT03-80ER10659.

The deformation of an initially spherical liquid drop moving under the action of gravity in another fluid with which it is completely miscible is investigated under conditions of small values of the drop Reynolds number. It is found experimentally that such a drop evolves into an open torus which subsequently expands, and this phenomenon is examined theoretically for two limiting drop geometries: (i) a slightly deformed spherical drop, and (ii) a highly expanded, slender open torus. Under the assumptions of zero interfacial tension and creeping flow, the theory provides a qualitative description for the initial stages of the drop evolution [case (i)], but is unable to account for the observed drop expansion during latter stages of deformation [case (ii)]. On the other hand, if small inertial effects are retained in the analysis, the theory predicts that a slender open fluid torus possessing an arbitrary cross-sectional geometry will expand without change of shape to first order in Reynolds number. Quantitative comparisons of theoretically predicted rates of expansion with experimental measurements suggest the possible existence of a small, time-dependent interfacial tension across the drop interface.

8739 **Computing variational bounds for flow through random aggregates of Spheres.** Berryman, J.G. (Lawrence Livermore National Laboratory, P. O. Box 808, L-200, Livermore, California 94550). *Journal of Computational Physics;* **52**: No. 1, 142-186(Oct 1983). Contract W-7405-ENG-48.

Known formulas for variational bounds on Darcy's constant for slow flow through porous media depend on two-point and three-poiint spatial correlation functions. Certain bounds due to Prager and Doi depending only a two-point correlation functions have been calculated for the first time for random aggregates of spheres with packing fractions (eta) up to eta = 0.64. Three radial distribution functions for hard spheres were tested for eta up to 0.49: (1) the uniform distribution or "well-stirred approximation," (2) the Percus Yevick approximation, and (3) the semi-empirical distribution of Verlet and Weis. The empirical radial distribution functions of Benett andd Finney were used for packing fractions near the random-close-packing limit (eta/sub RCP/d~0.64). An accurate multidimensional Monte Carlo integration method (VEGAS) developed by Lepage was used to compute the required two-point correlation functions. The results show that Doi's bounds are preferred for eta>0.10 while Prager's bounds are preferred for eta>0.10. The "upper bounds" computed using the well-stirred approximation actually become negative (which is physically impossible) as eta increases, indicating the very limited value of this approximation. The other two choices of radial distribution function give reasonable results for eta up to 0.49. However, these bounds do not decrease with eta as fast as expected for large eta. It is concluded that variational bounds dependent on three-point correlation functions are required to obtain more accurate bounds on Darcy's constant for large eta.

6450 High Energy Physics

REFER ALSO TO CITATION(S) 8836

8740 **(DOE/ER/05007—20) Particle theory, cosmology and relativity. Progress report, August 1, 1983-March 31, 1984.** Gaisser, T.K.; Steigman, G. (Delaware Univ., Newark (USA). Bartol Research Foundation). 9 Dec 1983. Contract AC02-78ER05007. 19p. NTIS, PC A02/MF A01. Order Number DE84003990.

Research progress is briefly described on the following topics: calculation of neutrino flux produced by cosmic rays, multiple muon events in deep underground detectors, large air showers, primordial nucleosynthesis, supersymmetry and equilibrium in the very early universe, the bag model of particle interactions, and particle theory in curved spaces. Publications are listed. (WHK)

8741 **(JINR—D-1,2-82-27) Spin in high energy physics.** (Joint Inst. for Nuclear Research, Dubna (USSR)). 1982. 345p. (In Russian). (CONF-811147—). NTIS (US Sales Only), PC A15/MF A01. Order Number DE84780046.

From International symposium on polarization phenomena at high energies; Dubna, USSR (17 Nov 1981).

The papers presented were entered into the data base separately. (WHK)

6451 Particle Interactions And Properties - Experimental

8742 (AC-Intern—82/01) Elastic scattering of muon neutrinos and muon antineutrinos from protons and neutrons. Samm, U. (Technische Hochschule Aachen (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet). Apr 1982. 73p. (In German.). Fachinformationszentrum Energie, Physik, Mathematik, Karlsruhe (Germany, F.R.).

The present thesis describes the observation of the elastic scattering of muon neutrinos and antineutrinos from neutrons and protons. The experiment was performed with an optical multiplate spark chamber of aluminium which was at the same time target and detector at the broad-band neutrino beam of the CERN proton synchrotron. About 400 000 spark chamber photographs were examined for single tracks of proton recoils in the q^2 range 0.2-1.0 $(GeV/c)^2$, and about 9 000 tracks were measured.

8743 (DOE/ER—0182) Report of the Technical Assessment Committee on University Programs. (USDOE Office of Energy Research, Washington, DC. High Energy Physics Div.). Oct 1983. 61p. NTIS, PC A04/MF A01. Order Number DE84004704.

In the course of the academic year 1982 to 1983, a Technical Advisory Committee on University Programs (TACUP) appointed by the High Energy Physics Division of DOE carried out a comprehensive review of the DOE-supported university-based program in high energy physics. Paralleling similar reviews of other portions of the DOE program, the main purpose of this review was an assessment of the quality of the individual university contracts funded by DOE. As a subsidiary part of its charge, TACUP was also asked to comment on the balance between the various components of the DOE high energy physics program and report general perceptions arising from its review of the separate contracts and from comments solicited from the high energy community.

8744 (DOE/ER/01428—502) Charged hadron composition of the final state in $e+e^-$ annihilation up to 1.9 GeV/c at E/sub cm/ = 29 GeV. Ong, P.P. (Purdue Univ., Lafayette, IN (USA)). Aug 1983. Contract AC02-76ER01428. 157p. (PU—83-505). NTIS, PC A08/MF A01. Order Number DE84004570.

Portions are illegible in microfiche products; Thesis.

The momentum distributions of hadrons produced in $e+e^-$ collisions at a center of mass energy of 29 GeV have been measured. The data used in this analysis were collected by the High Resolution Spectrometer (HRS) at the Positron Electron Project (PEP) in the Spring of 1982. The HRS is a general purpose particle detector consisting of a 16.2 kgauss solenoidal magnet, 17 layers of tracking chambers and multiple layers of lead-scintillator shower counters. The data consist of 8,200 hadronic events, corresponding to an integrated luminosity of 19.6 pbarn $^{-1}$ at E/sub cm/ = 29 GeV. Using the barrel shower counters' time-of-flight (TOF) measurements, charged particles in the momentum range 0.5 - 1.9 GeV/c are separated statistically. Measurements of differential cross sections, d σ /dp, scaled cross sections, S*(dσ/dXp), and charged particle fractions are presented and compared with measurements made by the TASSO and the JADE groups.

8745 (DOE/ER/01428—503) Search for scalar electrons at PEP. Wilson, R.J. (Purdue Univ., Lafayette, IN (USA)). Aug 1983. Contract AC02-76ER01428. 165p. (PU—83-508). NTIS, PC A08/MF A01. Order Number DE84004709.

Portions are illegible in microfiche products; Thesis.

Experimental results from e^+e^- reactions at the Positron Electron Project (PEP) using the High Resolution Spectrometer (HRS) are presented. Events with two electrons, and no other charged particles, in the final state are studied. Limits are given for the production of scalar-electrons predicted by models based on supersymmetry. In particular the pair production of such particles through s-channel single photon annihilation and t-channel inelastic scattering is considered. The data are well described by quantum electrodynamics (QED) but we observe one event which is also consistent with a supersymmetric model. Using this single event we find that the mass, M/sub se/, of these scalar-electrons es excluded, to 95% CL, in the range 1.8 $\leq$ M/sub se/ $\leq$ 14.2 GeV/c^2. A description of the HRS detector is given with particular emphasis on the electronic trigger system.

8746 (EFI—515(2)-82) Software for eta^0-meson photoproduction experiment. Skhtoryan, E.M. (Erevanskij Fizicheskij Inst. (USSR)). 1982. 22p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704194.

The software of the experiment on the investigation of the eta^0-meson photoproduction cross-section asymmetry with polarized photons is described. The software possibilities, allowing to solve the problem of separating the effect from the large physical background at experimental data processing are considered. The programs are written in FORTRAN and AVTOCODE.

8747 (FERMILAB-CONF—83/75-EXP) Recent results on D decays and lepton, photon, (and hadron) production of charm. Nash, T. (Fermi National Accelerator Lab., Batavia, IL (USA)). Sep 1983. Contract AC02-76CH03000. 48p. (CONF-8308101—6). NTIS, PC A03/MF A01. Order Number DE84003185.

From International symposium on lepton and photon interactions at high energies; Ithaca, NY, USA (4 Sep 1983).

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After a brief introduction to the experiments with results included in this review, we will discuss, in turn, production of psi and psi', production of open charm in lepton and photon beams, D decays, and give a brief token mention of recent hadroproduction results. Emphasis will be on results reported since the Paris conference (August, 1982), but we will try to include all results since the last Lepton Photon Conference at Bonn (August, 1981) as well as earlier results when necessary for comparison. 42 references.

8748 (IFVE-OEIPK—82-51) General characteristic of annihilation exclusive reactions in anti pp interactions at 32 GeV/c. Proskuryakov, A.S.; Murzin, V.S.; Sarycheva, L.I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1982. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704060.

Obtained evaluations of annihilation channel sections show that during transition from the region psub(lab) $<$ 10 GeV/c to the region psub(lab) $>$ 10 GeV/c observed is a more rapid decrease of averaged square of reaction matrix element with energy growth where psub(lab)- momentum of incident antiproton. Polar angle cosine distribution of pions from annihilation events is very anisotropic. Anisotropy degree increases with enhancing secondary pion pulse. The anisotropy dagree drops with multiplicity growth and for nsub(+-) >= 12 pion distribution approaches isotropic. Mean transverse momentum of pions from annihilation events exceeds psub(T) pion values from nonannihilation events. Analysis shows that this exceeding has a dynamic nature.

8749 (IFVE-OEIPK—82-145) Inclusive phi meson production in K^+p interactions at 70 GeV/c. Bars, M.; Vol'f, E.A.; Dyumon, Zh.Zh. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1982. 11p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704059.

Results on inclusive phi meson production in K^+p interactions at 70 GeV/c in the kaon fragmentation are considered. The differential cross section of the reaction is given. Comparison with the other data on phi meson production in K^{+-} and p induced reactions provides evidence that the strange valence-quark fragmentation or recombination processes play the dominant role in the K^{+-} $\rightarrow$ phi transitions. Arguments are presented that the kaon valence strange anti s-quark is much faster than u-quark. Evidence for the previously observed narrow phiπ^+ state at mass approximately 2.1 GeV is discussed.

8750 (IFVE-ONF—82-40) **Observation of the Compton effect on πp mesons.** Antipov, Yu.M.; Bezzubov, V.A.; Budanov, N.P. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1982. 7p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704061.

The π^- - meson-photon scattering (compton effect on π^- mesons) has been detected for the first time. The constant for charged pion polarizability is estimated to be asub(π)=(5+-4)x10sup(-43) cm^3.

8751 (IN2P3—81-1, pp 227-286) **High energy e^+e^- interaction and quantum chromodynamics. Experimental results.** Fournier, D. 1983. (In French). NTIS (US Sales Only), PC A13/MF A01. (CONF-8109247—).

From Summer school on particle physics; Gif-sur-Yvette, France (7 Sep 1981).

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e+e- interactions at PETRA-PEP energies (12 to 36 GeV) provide clear tests for QCD. First, results concerning annihilation total cross-section and inclusive spectra, in particular scaling violation, are considered. Next, energy-energy correlations, which provide an interesting test of QCD in the leading logarithm approximation, are reviewed. The third part deals with 3-jet events interpreted as evidence for hard gluon bremsstrahlung, and with various problems occuring in the determination of asub(s). e+e- annihilation on top of narrow resonances (γ), and deep inelastic electron-photon scattering, which allow important tests of the theory, are briefly considered in the last part.

8752 (INIS-mf—8299, pp 144-145) **Measurement of antiproton-proton cross sections at low momenta.** Ciborowski, J.; Majewski, S. (Heidelberg Univ. (Germany, F.R.). Physikalisches Inst.); Brueckner, W.; Doebbeling, H.; Kneis, H.; Povh, B.; Ransome, R.; Shibata, T.A.; Szwed, R.; Treichel, M. 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphyik: Annual report 1982.

In an experiment at the LEAR facility of CERN we intend to measure the proton-antiproton elastic and charge exchange differential cross sections over the full angular range, the annihilation cross section, and, via the optical theorem, the total cross section. The momentum range of 700 MeV/c to 200 MeV/c (230 MeV to 20 MeV kinetic energy) will be covered. At a later stage we hope to extend the measurement to 130 MeV/c (5 MeV) with a slightly modified detector arrangement. First of all the result of these measurements will allow a new and precise search for baryonium resonances and particularly the so-called S-meson. Secondly, a study of the anti-proton-proton interaction, and particularly of its isospin dependence, for low l partial waves will be possible.

8753 (INIS-mf—8664, pp 73) **Search for glueball resonances.** Mitaroff, W.A. (Oesterreichische Akademie der Wissenschaften, Vienna. Inst. fuer Hochenergiephysik). 1982. (In German). NTIS (US Sales Only), PC A05/MF A01. (CONF-8209185—).

From Annual conference of the Austrian Physical Society; Graz, Austria (22 Sep 1982).

Published in summary form only.

8754 (IPNO-TH—82-28) **Protonium and other exotic anti p-atoms.** Richard, J.M. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). May 1982. 12p. (CONF-8205103—10). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704042.

From Workshop on physics at LEAR with low energy cooled antiprotons; Erice, Italy (9 May 1982).

The spectroscopy of protonium and other antip-atoms represents an important part of the experimental program at LEAR. In this review the theoretical aspects of this physics are summarized. The exotic antip-atom are potentially rich in physical information. Apart from the Van der Waals force and antip magnetic moment, one can mention the antip polarizability, the nuclear polarizability, and the measurement of the tail of neutron distribution, an important check on the nuclear structure calculations.

8755 (IPNO-TH—82-32) **NantiN forces and annihilation in the potential approach.** Vinh Mau, R. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). May 1982. 16p. (CONF-8205103—11). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704043.

From Workshop on physics at LEAR with low energy cooled antiprotons; Erice, Italy (9 May 1982).

The future experimental program of LEAR justifies the necessity for a careful theoretical study of the nucleon-antinucleon interaction. The question is whether the baryonium states exist and if so, whether they can the described as NantiN bound states or resonances.

8756 (ISN—82-27) **First results with the experimental set-up at a Bugey reactor: neutrino oscillations, search of axions.** Hoummada, A. (Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires; Grenoble-1 Univ., 38 (France)). Jul 1982. 22p. (In French). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704084.

This work presents an experimental set-up at the Bugey PWR reactor to put into evidence neutrino oscillations. The first part describes a neutrino detector specially designed for the investigation of neutrino oscillations at two distances (13.50 m and 19 m) under the core of the reactor. Preliminary analysis are presented. The second part reports a search for axions, using the neutrino detector well-shielded volume. Created in competition with electro magnetic transitions, axion should be produced in abondance in the reactor core. This experiment excludes the existence of the axion of the standard model.

8757 (ISN—82-33) **Search for neutrino oscillation at Bugey.** Cavaignac, J.F.; Hoummada, A.; Koang, D.H.; Vignon, B.; Declais, Y.; Kerret, H. de; Pessard, H.; Thenard, J.M. (Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires). Jul 1982. 4p. (CONF-820718—48). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704086.

From 21. international conference on high energy physics; Paris, France (29 Jul 1982).

A progress report on the neutrino oscillation experiment undertaken at two distances from the core of a PWR reactor of the Bugey power plant is presented.

8758 (JINR—D-1,2-82-27, pp 125-136) **Inclusive processes on polarized deuteron and short-range NN interactions.** Strikman, M.I.; Frankfurt, L.L. (AN SSSR, Leningrad. Inst. Yadernoj Fiziki). 1982. (In Russian). NTIS (US Sales Only), PC A15/MF A01. (CONF-811147—).

From International symposium on polarization phenomena at high energies; Dubna, USSR (17 Nov 1981).

A possibility of using (e, ep) and (h, p) inclusive reactions at high energy on polarized deuterons for studying the spin structure of deuteron wave function and for obtaining data on the nature of short-time nucleon-nucleon interaction is discussed.

8759 (JINR—D-1,2-82-27, pp 6-30) **Polarization investigation of IHEP accelerator.** Nurushev, S.B. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1982. (In Russian). NTIS (US Sales Only), PC A15/MF A01. (CONF-811147—).

From International symposium on polarization phenomena at high energies; Dubna, USSR (17 Nov 1981).

Experimental results obtained in IHEP since 1972 up today in the GERA, PROZA facility, on bubble chambers and in the BIS LHE JINR facility, as well as the theoretical results and their comparison with the experimental data obtained later on at higher energies in the ZERN and FNAL accelerators are reviewed. Systematic investigation of polarized effects in elastic reactions of hadrons for modeless amplitude reduction is conducted. The first results on spin effects in inlcusive reactions with production of A, anti A in K^{+-}p interaction in diffraction processes with production of $K^+PI^+PI^-$ and pPI^+PI^- systems in inclusive formation of rho^0 mesons both in anti pp and in anti νN interactions are obtained. The results obtained promoted development of theoretical works

but some problems remained unsolved. Solution of these problems requires new polarization experiments of increased accuracy with application of polarized beams, study of new physical processes and conducting experiments at higher energies.

8760 (JINR—D-1,2-82-27, pp 65-68) **Study on the energy dependence of spin-spin correlation in the range of di-proton resonances.** Vovchenko, V.G.; Efimovykh, V.A.; Zhdanov, A.A. (AN SSSR, Leningrad. Inst. Yadernoj Fiziki). 1982. (In Russian). NTIS (US Sales Only), PC A15/MF A01. (CONF-811147—).

From International symposium on polarization phenomena at high energies; Dubna, USSR (17 Nov 1981).

Coefficients of polarization correlation Csub(NN) (90 deg) at 9 values of energy in the 550-950 MeV range with absolute error less than 0.05 are measured on the beams on JINR and LINP synchrocyclotrons. Csub(NN) values at the angles of 41 deg, 69 deg, 77 deg (T=550, 610, 630 MeV) and 50 deg at other energies have been obtained. The measurement results are presented together with predictions of the Arndt phase analysis and two variants of the Hoshizaki analysis conducted before and after publishing the results of the given experiment. Energy dependence of Csub(NN) (50 deg) does not reveal noticeable peculiarities and it well agrees with all the variants of the analysis. The considered total data do not substantiate certain conclusions on resonance character in pp interaction in the investigated energy range. The structure observed in respect to Csub(NN) (90 deg, p) is the consequence of different energy dependence of amplitudes of triplet and singlet scattering and it may be interpreted as a testify to presence of resonance or as a consequence of threshold phenomena in inelastic channels in the 550-750 MeV energy range.

8761 (JINR—D-1,2-82-27, pp 69-74) **Study on polarization effects in photodisintegration of deuterium.** Konovalov, O.G. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1982. (In Russian). NTIS (US Sales Only), PC A15/MF A01. (CONF-811147—).

From International symposium on polarization phenomena at high energies; Dubna, USSR (17 Nov 1981).

Measurements of proton polarization in the $\gamma+d \rightarrow p+n$ reaction at $E > 650$ MeV on linearly polarized photons of a linear accelerator KhPTI AS USSR are conducted. This experiment makes it possible to determine by a general technique polarization parameters Σ, P and T presented as different combinations of spiral amplitudes of the (γd/pn) system states. The following values of polarization parameters are obtained in the results of measurements: Esub(γ)=400 MeV, P=-0.425+-0.065; Σ=0.3+-0.035; T=0.033+-0.13; Esub(γ)=500 MeV; P=-0.4+-0.06; Σ=0.122+-0.045; T=0.25+-0.12. An essential growth of polarization is observed with the increase of photon energy.

8762 (JINR—D-1,2-82-27, pp 88-96) **Study on Λ - hyperons polarization, emitted in interactions of π^- - mesons and neutrons with carbon nuclei and in Λsub(π) dibaryons decay, produced in these interactions.** Shakhbazyan, B.A. 1982. (In Russian). NTIS (US Sales Only), PC A15/MF A01. (CONF-811147—).

From International symposium on polarization phenomena at high energies; Dubna, USSR (17 Nov 1981).

The results of measuring Λ-hyperon polarization produced in π^- meson interactions with 4.0 GeV/c pulse and interaction of neutrons with average 7.0 GeV/c pulse with carbon nuclei are presented. Polarization of Λ-hyperons emitted at dibaryon Λp system decay is also measured. The necessary data have been obtained from photos of propane bubble JINR chamber. Λ-hyperon polarization in the function of jump angle in the laboratory system measured in $\pi^- + {}^{12}C \rightarrow \Lambda + x$; $n + {}^{12}C \rightarrow \Lambda + x$ reactions does not depend either on the character or on energy of primary particle and it attains the maximum close to 100% near THETA=90 deg, i. e. in the cumulative region. These results agree with the data of other experiments as well as with predictions of quark-parton model with hard quark collision. Average polarization of Λ-hyperons from Λp dibaryon decay within the limits of the experiment error is almost equal to zero. This does not exclude a possibility of non-zero dibaryon spin.

8763 (JINR—D-1,2-82-27, pp 141-150) **Study on spin alignment of vector mesons in hadron interactions.** Vrba, V. 1982. (In Russian). NTIS (US Sales Only), PC A15/MF A01. (CONF-811147—).

From International symposium on polarization phenomena at high energies; Dubna, USSR (17 Nov 1981).

The basic results of the study on the spin characteristics of vector mesons produced by hadron interactions in binary and inclusive processes are reviewed. Quark polarization is considered. It is concluded that presence of rho° meson alignment in anti pp interactions, sections of rho° production in anti pp interactions at Psub(lab) < or approximately 20 GeV/c permits to relate the observed aliment mainly with valent-valent (VV) contribution into the process of anti qq → rho° quark recombination. The vector mesons produced in meson-nucleon interactions have at rather high transmitt pulses t or psub(perpendicular) the same character of spin alignment as rho° in pp interactions.

8764 (JINR—D-1,2-82-27, pp 172-174) **Measurement of the D,A,R Wolfenstein parameters and analysis of pp-scattering at 1 GeV.** Vovchenko, V.G.; Fedorov, O.Ya.; Shvedchikov, A.V. (AN SSSR, Leningrad. Inst. Yadernoj Fiziki). 1982. (In Russian). NTIS (US Sales Only), PC A15/MF A01. (CONF-811147—).

From International symposium on polarization phenomena at high energies; Dubna, USSR (17 Nov 1981).

D, A, R Wolfenstein parameters in pp scattering in 1 GeV proton energy range were determined on the proton beam of the synchrocyclotron. Polarization of the proton beam had different directions. The scheme of polarized beam production excluded the effect of false asymmetry. Polarization in pp scattering was measured at the same time with each of the parameters. Phase analysis of pp data at 970 MeV was conducted. Change of angular dependence of D, A, R parameters with proton energy growth characterizes change of contribution of certain amplitudes of scattering matrix. Determination of D, A, R parameters made it possible to rather definitely reproduce the amplitude of elastic pp scattering at 1 GeV and to point out the main peculiarities of spin-spin interaction in the range up to 1 GeV.

8765 (JINR—D-1,2-82-27, pp 187-194) **π^+ and π^0 - meson photoproduction by polarized photons on polarized protons.** Get'man, V.A.; Gorbenko, V.G.; Derkach, A.Ya. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1982. (In Russian). NTIS (US Sales Only), PC A15/MF A01. (CONF-811147—).

From International symposium on polarization phenomena at high energies; Dubna, USSR (17 Nov 1981).

The results of measuring cross section asymmetry on the Σ polarized photon beam Σ, cross section asymmetry T and polarization of recoil nucleons P on a polarized target for $\gamma p \rightarrow \pi^+ p$ and $\gamma p \rightarrow \pi^0 p$ reaction in the 280-450 MeV energy range, in the angle range of 30-150 deg s. c. m. and 60-135 deg s. c. m. respectively obtained in the double polarized experiment are presented. The energy independent multipole analysis of pion photoproduction reactions on the proton is exercised. The obtained values of multipole amplitudes are presented together with calculations based on the dispersion Schwela and Lebedev theory. The best description of the experimental values of multipole amplitudes is obtained when taking into account rho and ω meson exchange in the t channel.

8766 (JINR—D-1,2-82-27, pp 195-198) **Measurement of proton polarization in the $\gamma p \rightarrow p\pi^0$ reaction on linearly polarized photon beam.** Avakyan, R.O.; Avakyan, Eh.O.; Avetisyan, A.Eh. (Erevanskij Fizicheskij Inst. (USSR)) (and others). 1982. (In Russian). NTIS (US Sales Only), PC A15/MF A01. (CONF-811147—).

From International symposium on polarization phenomena at high energies; Dubna, USSR (17 Nov 1981).

Measurement results of Psub(xz)-constituent of the proton polarization vector in the $\gamma p \rightarrow p\pi^0$ reaction in the Esub(γ)=(0.8-1.5) GeV photon energy range are presented for the first time. The measurements have been conducted at the pion angle escape in the s. c. m. THETAsub($\gamma\pi$sup(0))*=60 deg. The experiment is conducted on the beam of linearly polarized photons with polarization vector at the angle of 450 deg to the reaction plane. In the energy

distribution Psub(xz) the observed structure of proton polarization is minimum at Esub(γ)=0.95 GeV γ quantum energy and it is maximum at Esub(γ)=1.25 GeV. The experimental data agree with the theoretical analysis of other authors. Angular dependences of polarization for two energy values Esub(γ)=1.05 GeV and Esub(γ)=1.15 GeV are presented. The measured polarization values in a narrow range of THETAsub(γπsup(0))* angles reveal a sharper angular dependence than the theoretical ones.

8767 (JINR-D—1,2-82-27, pp 53-64) **Polarization processes in quantum chromodynamics.** Efremov, A.V.; Teryaev, O.V. 1982. NTIS (US Sales Only), PC A15/MF A01. (CONF-811147—).

From International symposium on polarization phenomena at high energies; Dubna, USSR (17 Nov 1981).

The first order asymmetrics are considered. A short review of experimental data on Λ-polarization and on π^0-asymmetry and of the models proposed is given. It is argued that the statement that a large value of the effects contradicts the QCD which gives P approximately equals msub(q), is not true. It is shown that accurately taking into account all of the contributions of twist 3, including the axial and tensor terms in the density matrix, the contribution due to the epsilonsub(q) of motion in the Schwinger gauge, is equivalent to a mass M on the internal lines of a subprocess. This makes the subprocess gauge invariant and infrared stable and results in P approximately equal to M. The angular momentum conservation sum rule gives that M=Msub(B) - the mass of a polarized particle. Estimation of the quark-quark contributions to asymmetry gives, however, P approximately 3%. One can hope that the direct production subprocesses would give a more noticeable effect.

8768 (JINR-D—1,2-82-27, pp 75-87) **Structure in nucleon-nucleon system and dinucleon resonance.** Yokosawa, A. (Argonne National Lab., IL (USA)). 1982. NTIS (US Sales Only), PC A15/MF A01. (CONF-811147—).

From International symposium on polarization phenomena at high energies; Dubna, USSR (17 Nov 1981).

An extensive amount of data was obtained from measurements of proton-proton elastic scattering up to 5 GeV/c. Physics learned from these data as well as other related experimental results was summarized. A summary of structure in nucleon-nucleon system is given and dinucleon resonances are considered.

8769 (JINR-D—1,2-82-27, pp 175-186) **Λ and antiΛ polarization in polarized and unpolarized e^+e^- - collisions.** Ranft, G. (Karl-Marx-Universitaet, Leipzig (German Democratic Republic)). 1982. NTIS (US Sales Only), PC A15/MF A01. (CONF-811147—).

From International symposium on polarization phenomena at high energies; Dubna, USSR (17 Nov 1981).

Experiments with polarized electron beams were used for determination of the coupling parameters of z^0 to leptons and quarks as well as for study of fragmentation of quarks into hadrons with spin. In the linear e^+e colliders was created longitudinal polarized electron beams. Technical devices were being constructed to turn the electron transverse polarization in circular e^+e^- machines into a longitudinal one. Production of polarized quarks, polarized quark fragmentation into polarized Λ(anti Λ) production in e^+e^- collisions are considered.

8770 (LAPP-EXP—82-05) **Search for axions at a power reactor.** Cavaignac, C.; Hoummada, A.; Koang, D.H. (Grenoble-1 Univ., 74 - Annecy (France). Lab. de Physique des Particules). Oct 1982. 13p. (ISN—82-46). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704093.

A search has been conducted for the axion at the Bugey reactor which is owned and operated by Electricite de France. The axion production should be proportional to the magnetic transition of np capture, and be detectable by its decay into 2 γ rays. No signal was observed in this measurement. Also no axion signal was seen from a single proton magnetic transition of ^{97}Nb. Using those two results, the axion can be excluded with a mass up to 1 MeV in the Peccei-Quinn formalism.

8771 (RL—82-092) **Differential cross section and polarisation for $\pi^- p \rightarrow K^+ \Sigma^+$ at 26 momenta between 1.282 and 2.473 GeV/c.** Candlin, D.J.; Lowe, D.C.; Peach, K.J. (Science Research Council, Chilton (UK). Rutherford and Appleton Labs.). Nov 1982. 33p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83704062.

Differential cross sections and polarisations in the reaction $\pi^+ p \rightarrow K^+ \Sigma^+$ have been measured using the Rutherford Multiparticle Spectrometer at NIMROD. Data are presented at 26 momentum points at approximately 50 MeV/c intervals in the range 1.282 to 2.473 GeV/c with an order of magnitude more events than previous experiments. Legendre polynomial expansion coefficients have also been determined.

8772 (RL—82-108) **Evidence for a narrow NN-bar state at 2.02 GEV/C^2 in 6 and 9 GEV/C antiproton interactions.** Azooz, F.; Butterworth, I.; Dornan, P.J. (Science Research Council, Chilton (UK). Rutherford and Appleton Labs.). Nov 1982. 5p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704063.

Evidence for the existence of a charged narrow state of mass M approximately 2.02 GeV/c^2 and width GAMMA approximately < 0.04 GeV/c^2, decaying into NN-bar is reported. The state was observed in the reaction p-barp → psub(fast)n-bar$\pi^+\pi^-\pi^-$ at 6 GeV/c and in p-barp → π^+sub(fast)p-bar$\pi^+\pi^-$ at 9 GeV/c in a triggered bubble chamber experiment at the SLAC Hybrid Facility.

8773 (SLAC-PUB—3243) **Study of heavy quark production with the Mark II at PEP.** Abrams, G.; Amidei, D.; Baden, A.; de la Vaissiere, C.; Gidal, G.; Gold, M.; Goldhaber, G.; Golding, L.; Herrup, D.; Juricic, I. (Lawrence Berkeley Lab., CA (USA); Stanford Linear Accelerator Center, CA (USA); Harvard Univ., Cambridge, MA (USA)). Oct 1983. Contract AC03-76SF00515;AC03-76SF00098. 17p. (LBL—16824; CONF-8304142—1). NTIS, PC A02/MF A01. Order Number DE84004600.

From 7. international conference on meson spectroscopy; Upton, NY, USA (14 Apr 1983).

The methods adopted by the Mark II collaboration to study heavy quark production at PEP are described. Two complementary techniques are used: D^* tagging using the decay chain D^{*+}? $D^0\pi^+$, $D^0 \rightarrow K^-\pi^+$, and inclusive lepton tagging using the characteristic p/sub T/ distributions to distinguish contributions from b and c quarks. These techniques are used to derive information about heavy quark fragmentation and about the weak coupling of heavy quarks.

8774 (SLAC-PUB—3248) **Properties of b-flavored hadrons.** Jaros, J.A. (Stanford Linear Accelerator Center, CA (USA)). Oct 1983. Contract AC03-76SF00515. 11p. (CONF-8308131—2). NTIS, PC A02/MF A01. Order Number DE84003861.

From 3. international conference on physics in collision; Como, Italy (31 Aug 1983).

Experimental progress in the study of b-flavored hadrons is reviewed. The observation of the B meson, properties of hadronic B decays, semi-leptonic B decays, and the B lifetime are discussed. 30 references.

8775 **Limits on the neutrino oscillations nu-bar/sub μ/ →nu-bar/sub e/ and nu-bar/sub μ/→nu-bar/sub tau/ using a narrow-band beam.** Taylor, G.N.; Cence, R.J.; Harris, F.A.; Jones, M.D.; Parker, S.T.; Peters, M.W.; Peterson, V.Z.; Stenger, V.J.; Ballagh, H.C.; Bingham, H.H. (Department of Physics and Astronomy, University of Hawaii, Honolulu, Hawaii 96822). *Physical Review* [*Section*] *D: Particles and Fields;* **28**: No. 11, 2705-2713(1 Dec 1983).

In an exposure of the Fermilab 15-ft bubble chamber to the dichromatic antineutrino beam, 427 nu-bar/sub μ/ charged-current interactions were obtained. Taking advantage of the small and well understood background flux of nu-bar/sub e/'s in the dichromatic nu-bar/sub μ/ beam, upper limits on the rates of antineutrino oscillations are obtained, with the precision limited by statistical rather than systematic errors, in contrast to previous experiments. The 90%-C.L. upper limits obtained for the average oscillation probabil-

ities indicated are P(nu-bar/sub μ/→nu-bar/sub e/)<6.5 x 10^{-3} and P(nu-bar/sub μ/→nu-bar/sub tau/)<4.4 x 10^{-3}. The mean value of the distance from the neutrino-production point to the bubble chamber divided by the neutrino energy, <l/E>, is 0.03 m/MeV.

8776 Study of νd charged-current two-pion production in the threshold region. Day, D.; Ammar, R.; Coppage, D.; Davis, R.; Kwak, N.; Stump, R.; Barish, S.J.; Engler, A.; Kraemer, R.W.; Miller, K. (University of Kansas, Lawrence, Kansas 66045). *Physical Review [Section] D: Particles and Fields;* **28**: No. 11, 2714-2720(1 Dec 1983).

We present our final results on double-pion production by muon-type neutrinos observed in a 2.4 x 10^6 (365 000) picture exposure of the Argonne 12-foot deuterium- (hydrogen-) filled bubble chamber. The reactions $\nu d \to \mu^- \pi^- \pi^+ pp$/sub s/, $\nu d \to \mu^- \pi^+ \pi^0 pn$/sub s/, and $\nu d \to \mu^- \pi^+ \pi^+ nn$/sub s/ are studied. The data, which shows strong $\Delta(1236)$ production, has nucleon-π-π mass distribution peaked at low masses in all three reactions. The excitation functions for the three reactions exhibit a rapid rise over the energy range from threshold up to about 3 GeV, but thereafter the energy dependence appears less pronounced. The threshold behavior of the cross sections for these reactions is analyzed in the context of a model developed by Adjei, Dicus, and Teplitz. Data from the constrained reaction, $\nu d \to \mu^- \pi^- \pi^+ pp$/sub s/, satisfy the Adler conserved-vector-current test.

8777 Study of acollinear muon pair production in e^+e^- interactions at E/sub c.m./ = 29 GeV. Fernandez, E.; Ford, W.T.; Reed, A.L. Jr.; Smith, J.G.; Marini, A.; Peruzzi, I.; Piccolo, M.; Ronga, F.; Blume, H.T.; Venuti, J.P. (Department of Physics, University of Colorado, Boulder, Colorado 80309). *Physical Review [Section] D: Particles and Fields;* **28**: No. 11, 2721-2725(1 Dec 1983). Contract AC02-81ER40025;AC03-76SF00515;AC02-76ER00881.

We have studied the production of acollinear muon pairs in e^+e^- interactions using the MAC detector at PEP. The results are totally accounted for by the QED processes $e^+e^- \to e^+e^-\mu^+\mu^-$ and $e^+e^- \to \mu^+\mu^-\gamma$ in which only the muon pairs are detected. We have also searched for the production of the supersymmetric partners of the muon. The existence of a spin-0 supersymmetric partner of the muon with a mass <13.8 GeV/c^2 is excluded at the 95% confidence level.

8778 Exclusive neutral-current reaction ν/sub μ/n→ν/sub μ/pπ^- in the BNL 7-foot deuterium bubble chamber. Baker, N.J.; Cnops, A.M.; Connolly, P.L.; Kahn, S.A.; Kirk, H.G.; Murtagh, M.J.; Palmer, R.B.; Samios, N.P.; Tanaka, M.; Kitagaki, T. (Brookhaven National Laboratory, Upton, New York 11973). *Physical Review [Section] D: Particles and Fields;* **28**: No. 11, 2900-2902(1 Dec 1983).

We have measured the cross-section ratio $R = \sigma(\nu p \pi^-)\ p\ /\ \sigma(\mu^- p \pi^+) = 0.11 +- 0.023, 0.13 +- 0.023, 0.15 +- 0.025$ for M/sub p/π<1.4, 1.6, 2.0 GeV, respectively, in the energy range 0.4<E/sub ν/<3.0 GeV. The data are consistent with various weak one-pion production models incorporating the Weinberg-Salam structure of neutral currents.

8779 p/sub t/ and E/sub t/ multiplicity correlations in p-p, p-α, and α-α interactions at $\sqrt{s}$ = 31.5 and 44 GeV. Gordon, H.; Killian, T.; Ludlam, T.; Stumer, I.; Winik, M.; Woody, C.; Botner, D.; Burkert, V.; Fabjan, C.W.; Frandsen, P. (Brookhaven National Laboratory, Upton, New York 11973). *Physical Review [Section] D: Particles and Fields;* **28**: No. 11, 2736-2740(1 Dec 1983).

Measurements of the central multiplicity associated with high-p/sub t/ particles up to 2 GeV/c in p-p, p-α, and α-α collisions, and measurements of dσ/dE/sub t/ are presented. The difference in associated multiplicity, n(p-α)-n(p-p), is independent of p/sub t/ while n(α-α)-n(p-p) rises with p/sub t/, providing new information on the "anomalous" p/sub t/ dependence of nuclear inclusive cross sections.

8780 Inclusive photoproduction of π0 and eta⁰ mesons for photons in the 100-GeV energy range. Breakstone, A.M.; Cheng, D.C.; Dorfan, D.E.; Grillo, A.A.; Heusch, C.A.; Palladino, V.; Sadrozinski, H.F.; Schalk, T.; Seiden, A.; Smith, A.D.B. (Institute for Particle Physics, Universtiy of California, Santa Cruz, California 95064). *Physical Review Letters;* **51**: No. 18, 1617-1620(31 Oct 1983).

Inclusive distributions are presented for final-state π^0 and eta⁰ mesons produced in γp interactions. For photon energies from 50 to 130 GeV, both cross sections scale for fractional momenta x/sub F/> or =0.30. The average transverse momentum for both mesons is approximately constant with energy and equal to 0.51 +- 0.05 GeV/c at large x/sub F/. The eta/sup 0//π^0 ratio rises from 0.07 +- 0.03 at x/sub F/ = 0.38 to 0.30 +- 0.09 at x/sub F/ = 0.90. The π^0 distributions are in good agreement with those seen in the scattering of highly virtual incident photons.

6452 Particle Interactions And Properties - Theoretical

REFER ALSO TO CITATION(S) 8689, 9001, 9002, 9005, 9068

8781 (IN2P3—81-1, pp 180-208) **Deep inelastic scattering.** Aubert, J.J. 1983. (In French). NTIS (US Sales Only), PC A13/MF A01. (CONF-8109247—).

From Summer school on particle physics; Gif-sur-Yvette, France (7 Sep 1981).

Portions are illegible in microfiche products.

The deep inelastic scattering of muons and neutrinos on protons and neutrons is used to determine the structure functions of nucleons. After a short review of the meaning of structure functions as quark distributions, experimental results are given, concerning the values of R, F_3 and x F_3. The measurements of sea-quarks distributions give an estimate of the Q^2-dependence of the distribution of the glue. The Q^2- dependence of the structure functions allows a precise determination of the scale parameter and of higher order terms.

8782 (INIS-mf—8299, pp 156) **Topological cross sections in hadron-nucleon and hadron-nucleus collisions at very high energies.** Chao, W.Q. (Academia Sinica, Beijing (China). Inst. of High Energy Physics); Hegab, M.K. (Cairo Univ. (Egypt). Dept. of Physics); Pirner, H.J. 1983. NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

8783 (INIS-mf—8299, pp 156) **Quark bag coupling to finite size pions I.** Kam, J. de; Pirner, H.J. 1983. NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

8784 (INIS-mf—8299, pp 156) **Quark bag coupling to finite size pions II.** Kam, J. de; Pirner, H.J. 1983. NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

8785 (INIS-mf—8299, pp 156) **Nonlocality effects on the pion nucleon form factor.** Kam, J. de. 1983. NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

8786 (INIS-mf—8299, pp 157) **QCD and the s-wave K^+N interaction.** Pirner, H.J.; Bender, I.; Dosch, H.G. 1983. NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

8787 (INIS-mf—8299, pp 156) **Additive quark model for the spin orbit interaction.** Pirner, H.J.; Povh, B. 1983. NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

8788 (INIS-mf—8307, pp 116-118) **Soliton bag dynamics.** Wilets, L.; Goldflam, R.; Dethier, J.L.; Schuh, A.; Henley, E.M. (Washington Univ., Seattle (USA). Inst. for Nuclear Theory). 1983. NTIS (US Sales Only), PC A11/MF A01. (CONF-830118—).

From 11. international workshop on gross properties of nuclei and nuclear excitations; Hirschegg, Austria (17 Jan 1983).

The soliton model of interacting quarks and gluons, introduced by Friedberg and Lee (1977), effects both spatial and color confinement of the constituents. Because the model is described by a complete Hamiltonian, the dynamics of the system can be followed unambiguously. For this purpose, we employ theoretical methods which have proved effective in the study of nuclear collective motion, heavy ion collisions, and fission.

8789 (INIS-mf—8630) **Physics with low energy pions and muons.** Konijn, J. (Nationaal Inst. voor Kernfysica en Hoge-Energiefysica (NIKHEF), Amsterdam (Netherlands). Sectie K). 1981. 311p. (In Dutch). NTIS (US Sales Only), PC A14/MF A01. Order Number DE83704739.

This document is a collection of texts used for a course of lectures given by the author at the Technical University of Delft (NL) in 1981. It is therefore a comprehensive, Dutch language, review article starting with the discovery of pions and muons, describing their properties and finally discussing their applications in low energy physics.

8790 (INIS-mf—8664, pp 16) **Collaboration of NA 16.** Rohringer, H. (Oesterreichische Akademie der Wissenschaften, Vienna. Inst. fuer Hochenergiephysik). 1982. (In German). NTIS (US Sales Only), PC A05/MF A01. (CONF-8209185—).

From Annual conference of the Austrian Physical Society; Graz, Austria (22 Sep 1982).

Published in summary form only.

8791 (INIS-mf—8664, pp 73) **Some new results concerning estimations of π - π phase shifts and relationship to diffractive dissociation.** Macnaughton, J. (Oesterreichische Akademie der Wissenschaften, Vienna. Inst. fuer Hochenergiephysik). 1982. NTIS (US Sales Only), PC A05/MF A01. (CONF-8209185—).

From Annual conference of the Austrian Physical Society; Graz, Austria (22 Sep 1982).

Published in summary form only.

8792 (INIS-mf—8664, pp 74) **Inelastic electron-deuteron scattering with polarized particles.** Schwarz, K.; Zingl, H.F.K.; Mathelitsch, L. (Graz Univ. (Austria). Inst. fuer Theoretische Physik). 1982. (In German). NTIS (US Sales Only), PC A05/MF A01. (CONF-8209185—).

From Annual conference of the Austrian Physical Society; Graz, Austria (22 Sep 1982).

Published in summary form only.

8793 (INIS-mf—8664, pp 75) **Off-shell behaviour of the proton-proton interaction.** Thaler, J.; Zingl, H.F.K. (Graz Univ. (Austria). Inst. fuer Theoretische Physik). 1982. (In German). NTIS (US Sales Only), PC A05/MF A01. (CONF-8209185—).

From Annual conference of the Austrian Physical Society; Graz, Austria (22 Sep 1982).

Published in summary form only.

8794 (INIS-mf—8664, pp 77) **Quark models and nucleon-nucleon interaction.** Baier, H. (Vienna Univ. (Austria). Inst. fuer Radiumforschung und Kernphysik). 1982. (In German). NTIS (US Sales Only), PC A05/MF A01. (CONF-8209185—).

From Annual conference of the Austrian Physical Society; Graz, Austria (22 Sep 1982).

Published in summary form only.

8795 (INIS-mf—8664, pp 78) **Selected topics from medium energy physics.** Ericson, T. (CERN, Geneva (Switzerland)). 1982. NTIS (US Sales Only), PC A05/MF A01. (CONF-8209185—).

From Annual conference of the Austrian Physical Society; Graz, Austria (22 Sep 1982).

Published in summary form only.

8796 (IPNO-TH—82-16) **Spin effects in low energy proton-antiproton forward elastic scattering.** Lacombe, M.; Loiseau, B.; Moussallam, B.; Vinh Mau, R. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). 1982. 11p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704069.

Predictions of the antipp forward elastic cross section and of the real to imaginary ratio rho given by the NantiN interaction we proposed recently are reported. Our cross sections compare very well with recent measurements at 400<psub(L)<730 MeV/c and 700 MeV/c. It is also shown that spin effects cannot be neglected in the determination of rho as usually assumed.

8797 (ITEP—43(1982)) **Gluino and photino masses.** Vysotsky, M.I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1982. 12p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704044.

Possible mechanisms for gluino and photino masses generation are investigated. It is shown that nonzero gluino mass produces photino mass and vice versa. The only way to satisfy experimental limit of the gluino mass Msub(lambdasub(g)) > 3-5 GeV is to give Lagrangian mass to gluino. This leads to nonzero photino mass, but its particular value is free parameter of the theory. Cosmological limits for photino mass are presented.

8798 (ITEP—45(1982)) **Power correction to the asymptotics of the pion electromagnetic form factor.** Geshkenbein, B.V.; Terentyev, M.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1982. 56p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE83704045.

The contribution of the power correction approximately $(\mu^2/Q^2)^2$ enhanced by the factor approximately μ^2/anti m^2, to the pion form factor (FF) is calculated (here μ is the pion mass, anti m=1/2(msub(u)+msub(α)) is the mean value of the u- and d-quark masses, $Q^2=-(p-p')^2 > 0$, where p, p' are meson momenta at initial and final state. It is shown that the only source of large corrections is due to the contribution of the local pseudoscalar current. The main (approximately $1/Q^2$) asymptotics of FF associated with the axial current contribution, is derived. The contribution (approximately $1/Q^4$) of the pseudoscalar current is calculated.

8799 (ITEP—75(1982)) **Muon number nonconservation in the models with massive Majorana neutrino.** Martemyanov, B.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1982. 4p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704046.

The probabilities of the processes $\mu \to e\gamma$ and $e^+e^- \to \mu^+e^-$ are calculated in the models of massive Majorana neutrino. The obtained results showed that only Gelmini and Roncadelli nodel predictions for $\mu \to e\gamma$ and $e^+e^- \to \mu^+e^-$ processes are relatively large and may be experimentally verificated.

8800 (ITEP—76(1982)) **Etasub(c) $\to 2\gamma$ decay and power correction.** Aliev, T.M. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1982. 10p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704047.

The power corrections to etasub(c) $\to 2\gamma$-decay are estimated in the framework of the sum rules QSD. It is clear that the power corrections to etasub(c) $\to 2\gamma$ come only from the gluon condensate. This is due to the fact that for heavy quark operator < anti psisub(c)psisub(c)> approximately 1/msub(c) and hence the contribution of quark condensate is suppressed. Obtained are that decay width is GITA(etasub(c) $\to 2\gamma$) = (6.4R +-0.64) keV. For comparison reminded are that without power corrections the decay width GITA(etasub(c) $\to 2\gamma$) approximately 6 keV. From this it

follows that the power corrections to the etasub(c) → 2γ decay width are of the order of 10%.

8801 **(ITEP—77(1982)) Proton decay due to d=5 operators.** Aliev, T.M.; Vysotsky, M.I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1982. 14p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704048.

Proton decay due to d=5 operators in SUSY GUT models are considered. Matrix elements of appearing four fermion operators are calculated. Experimental lower bound for proton life time lead to an upper bound for W-bosino Majorana mass: Msub(lambdasub(W)) < 5 GeV. A model with softly broken low energy SUSY and natural suppression of lambdasub(W) and lambdasub(Z) Majorana masses is presented. In this model d=5 operators produce proton decay through Majorana gluino mass. The only decay mode is p → Ksup(+)vsub(μ). For Mlambdasub(g)=13 GeV are obtained tausub(p)=10^{31} years.

8802 **(ITEP—97(1982)) Exponential dependence of deep-inelastic cross sections on the quark transverse momentum.** Ioffe, B.L. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1982. 6p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704049.

Proceeding from QCD sum rules it is shown that the production cross sections of a quark (or hadronic jets) with transverse momentum Ksub(perpendicular) in deep inelastic processes in the range of not very large Ksub(perpendicular) depend on Ksub(perpendicular)sup(2) exponentially.

8803 (JINR—D-1,2-82-27, pp 97-107) **Polarization phenomena at high energies and small momentum transfer.** Kopeliovich, B.Z. 1982. (In Russian). NTIS (US Sales Only), PC A15/MF A01. (CONF-811147—).

From International symposium on polarization phenomena at high energies; Dubna, USSR (17 Nov 1981).

Some polarization phenomena at high energies and small momentum transfer are reviewed. Polarization in the process of recharge is considered in the Regge approach. Polaron spin structure is discussed. A model of quark constituents inclusive reactions, three-regge limit are considered. The considered examples reveal that polarization effects at high energies are negligible, as a rule, their determination requires essential efforts. But interest for these phenomena grows because their study is one of the most exact and sensitive methods for investigation of particle interaction dynamics.

8804 (JINR—D-1,2-82-27, pp 108-118) **Coupling of peripheral and hard processes and polarization phenomena.** Kajdalov, A.B. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1982. (In Russian). NTIS (US Sales Only), PC A15/MF A01. (CONF-811147—).

From International symposium on polarization phenomena at high energies; Dubna, USSR (17 Nov 1981).

Certain model ideas on the character of effects associated with confinement, based on topological (1/Nsub(f))-decay as well as on models of string and colored tube permit to consider from the general view point hadron production in peripheral and hard processes. It is revealed that many characteristics of hard processes can be expressed in terms of trajectory crossing of Regge poles. The developed approach is applied for the analysis of hadron final states in e^+e^- annihilation at large Q^2. Polarization phenomena in the processes of hadron-hadron interaction with small transmitted pulses are discussed within the frames of quark-gluon and multiperipheral models. Study of polarization phenomena in e^+e^- annihilation, hadron-hadron processes with small psub(t) and deep inelastic lepton scattering permit to obtain significant data on the role of confinement effects and quark-parton structure of hadrons.

8805 (JINR—D-1,2-82-27, pp 137-140) **Eikonal character of hadrons small angle scattering and role of spin effects at high energies.** Goloskokov, S.V.; Kuleshov, S.P.; Selyugin, O.V.; Teplyakov, V.G. 1982. (In Russian). NTIS (US Sales Only), PC A15/MF A01. (CONF-811147—).

From International symposium on polarization phenomena at high energies; Dubna, USSR (17 Nov 1981).

The problem of the role of spin effects in the processes of hadron elastic scattering at high energies in a wide range of pulse transmission: S > or approximately 500 GeV^2 t <= 12 GeV is discussed. Investigations of energy dependence of amplitudes with spin roll are conducted within the frames of quasipotential Logunov-Tavkhalidze approach on the base of hypothesis on smoothness of the local quasipotential producing adequate description of scattering processes at small angles at high energies.

8806 **(JINR—R-2-82-263) Nucleon structure functions in the composite quark-diquark model.** Linkevich, A.D.; Aavrin, V.I.; Sanadze, V.V.; Skachkov, N.B. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1982. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704051.

An explicit expression is found for the nucleon structural functions through relativistic single-time wave functions of the quark-diquark system. The formulae obtained independently of the quark interaction dynamics (which determines the wave function form) contain both the term resulting in the xi-scaling violation and solely scaling terms. The form of the scaling part and the character of violation of the structural function scale-invariance behaviour by the prescaling terms are determined by the form of wave functions. The deep-inelastic limit contains the relation of the Callan-Gross form.

8807 **(JINR—R-2-82-712) Decays of $A_1 \to \pi\gamma$, $B \to \pi\gamma$.** Efimov, G.V.; Kuz'min, V.A.; Solomonovich, M.M. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1982. 4p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704053.

In the framework of nonlocal quark model the widths and the amplitudes of decays $A_1(1240)$ and B(1235) to $\pi+\gamma$ are calculated. The following values for decay widths: $GITA(A_1 \to \pi\gamma)$ = 250 KeV, $GITA(B \to \pi\gamma)$ = 160 KeV are obtained. The values obtained are in agreement with the available experimental estimation.

8808 **(LAPP-TH—66) Properties of W-boson within the subconstituent models of electroweak interactions.** Narison, S. (Grenoble-1 Univ., 74 - Annecy (France). Lab. de Physique des Particules). Aug 1982. 12p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750219.

We discuss some properties of the W-boson using spectral function sum rules within the framework of constituent models of quantum haplo-dynamics (QHD).

8809 **(LAPP-TH—68) Some dynamical properties of the subconstituent models of electroweak interactions.** Narison, S. (Grenoble-1 Univ., 74 - Annecy (France). Lab. de Physique des Particules). 11 Oct 1982. 14p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750218.

We determine the order of magnitude value of the haplon vacuum condensate and the W-W' level spacing using spectral function sum rules for the electroweak constituent models of quantum haplo-dynamics (QHD). We also discuss some consequences of the QHD model with massive haplons. We conclude that the haplons of QHD which bind the W-boson are very similar to the u,d quarks of QCD. The models with massive haplons would imply the existence of exotic light pseudoscalar bosons. Some implications of these exotic particles for low-energy phenomenology are discussed.

8810 **(LBL—16800) Signatures of new phenomena in ultrarelativistic nuclear collisions.** Gyulassy, M. (Lawrence Berkeley Lab., CA (USA)). Nov 1983. Contract AC03-76SF00098. 30p. (CONF-8309168—5). NTIS, PC A03/MF A01. Order Number DE84004341.

From 3. international conference on ultra-relativistic nucleus-nucleus collisions; Upton, NY, USA (26 Sep 1983).

Three classes of observables are discussed which may shed light on the properties of the quark-gluon plasma formed in ultrarelativistic nuclear collisions. They are: (1) thermometers: the pene-

trating probes $\mu^+\mu^-$, γ, c, (2) barometers: transverse flow via <p perpendicular >, and (3) seismometers: fluctuations of dN/dy and dE perpendicular/dy. The need for reliable estimates of the background due to the non-equilibrium processes is emphasized. 49 references.

8811 **(LYCEN—8224) Symmetries and aggregates of quarks as constituents of hadrons.** Kibler, M. (Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire). Jul 1982. 18p. (CONF-820797—1). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704055.

From International symposium on symmetries and properties of non-rigid molecules; Paris, France (1 Jul 1982).

The interest of the Lie algebra of the group SU(n) for the classification of hadrons and the description of some of their static properties is emphasized for n=3, 4, 6, 8. The cases n=3 and 4 allow to introduce the quark flavors (u,d,s,) and (u,d,c,s), respectively, and the consideration of the spin of hadrons leads to the chain SU(2m) contains SU(m) x SU(2). The hadrons are described as bound states or aggregates of quarks of type quark-quark-quark for baryons and quark-antiquark for mesons. The Pauli exclusion principle applied to the three-quark baryons requires the introduction of a new quantum number, the color: each flavor of quark then comes in three colors.

8812 **(PCCF-T—82-02) Study of various corrections to the jet production by photon-photon collisions.** Missonnier, G. (Clermont-Ferrand-1 Univ., 63 (France)). Jun 1982. 72p. (In French). NTIS (US Sales Only), PC A04/MF A01. Order Number DE83704056.

We have separately considered the various corrections at the zero order calculations to the ee → ee qantiq reaction: corrections to the Williams-Weizsacker approximations; Q.E.D. radiative corrections; gluonic corrections. Numerical calculation has shown corrections to the Williams-Weizsacker are not so small specially for high Psub(t). At $\sqrt{s}$=30 GeV, gluonic corrections are negative and relatively high. They weaken at higher energy. Conversaly Q.E.D. radiative corrections are negligeable. We give the combined effects of these different corrections for the four quarks u, d, s, and c.

8813 **(RL—82-110) Where are hermaphrodite baryons.** Barnes, T.; Close, F.E. (Science Research Council, Chilton (UK). Rutherford and Appleton Labs.). Nov 1982. 7p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704057.

The ground state spectrum of QQ-barG and QQQG hadrons is studied in the MIT bag model including 0(αsub(s)) QCD forces. If there are no 0^{-+} (QQ-barG) states below 1.3 GeV then only P_{11} and $P_{13}Q^3G$ states can occur below 2 GeV, I = 3/2 being repelled to high masses. Possibilities of establishing hermaphrodite states are discussed.

8814 **Helicity formalism for transition amplitudes.** Pasarino, G. (Stanford Linear Accelerator Center, Stanford University, Stanford, California 94305). *Physical Review* [*Section*] *D: Particles and Fields;* **28**: No. 11, 2867-2871(1 Dec 1983). Contract AC03-76SF00515.

Transition amplitudes between states with spin < or =1 are considered and directly evaluated in terms of momenta and polarization vectors. A special algorithm is derived to reduce expressions where γ matrices of different lines are saturated. The application of the method is illustrated for radiative and nonradiative processes, including mass effects.

8815 **Quark anomalous magnetic moments and constraints on the composite structure of quarks.** Fajfer, S.; Oakes, R.J. (Department of Physics and Astronomy, Northwestern University, Evanston, Illinois 60201). *Physical Review* [*Section*] *D: Particles and Fields;* **28**: No. 11, 2881-2884(1 Dec 1983).

The angular distribution of lepton pairs produced in hadronic interactions and the angular distribution of two-jet events in electron-positron annihilation are shown to provide a possible means to measure the anomalous magnetic moment $\kappa = (g-2)/2$ of a confined quark. Present data imply that $\kappa <$ or $\approx 10^{-4}$ for u and d quarks, compared to 10^{-8} for muons and 10^{-10} for electrons, leaving open the interesting possibility of a genre of models in which leptons behave as elementary Dirac particles while quarks may exhibit substructure throughout some intermediate energy regime. The magnitude of the anomalous magnetic moment one expects due to quantum-chromodynamic vertex corrections to a confined quark's electromagnetic interaction is estimated and found to be not much smaller than the present experimental upper limits on κ, suggesting that the first observation of g-2 for quarks may be feasible in the not too distant future.

8816 **Supersymmetric decay widths of weak bosons.** Barger, V.; Robinett, R.W.; Keung, W.; Phillips, R.J.N. (Physics Department, University of Wisconsin, Madison, Wisconsin 53706). *Physical Review* [*Section*] *D: Particles and Fields;* **28**: No. 11, 2912-2914(1 Dec 1983).

The partial widths of W and Z decays to supersymmetric particles are evaluated in the simplest N = 1 supergravity model. The total widths can be 50% greater than the standard-model predictions. Measurements of the widths at the p-barp collider can thereby be used either to place improved lower limits on gaugino, scalar-quark, and scalar-lepton masses or to provide indirect evidence for supersymmetry.

8817 **Vector-meson mixing and hadronic decays of psi.** Clavelli, L.J.; Intemann, G.W. (High Energy Physics Division, Argonne National Laboratory, Argonne, Illinois 60439). *Physical Review* [*Section*] *D: Particles and Fields;* **28**: No. 11, 2767-2771(1 Dec 1983).

A phenomenological model for the hadronic decays of psi is proposed, where the vector mesons (rho,ω,phi,psi) undergo mixing through contamination of light and charmed quarks. The decay widths of several two-body hadronic modes are predicted and compared with the current experimental data. Isospin-violating decays are included in the analysis and, in particular, the process psi→$\omega\pi$ is predicted to have a width large enough to be experimentally observable.

8818 **Hadronic couplings and the quark model.** Maciel, A.K.A. Oxford, England; Oxford University (1981). 116p. British Library, Boston Spa, Wetherby, West Yorks. No. D44226/83.

A general relation between P and S matrices is derived in detail and used in estimates of quark model mass shifts due to hadronic couplings. It is shown that these shifts are not negligible effects and ought to be taken into account in detailed quark model fits to data. A treatment of QCD perturbation theory in a cavity is presented, and the quark-gluon vertex rules are developed in detail. The P-matrix and perturbative QCD techniques are applied to a model of the decays of the baryon decuplet. This model consists in allowing the valence 'q^3> baryon configuration to mix with 'q^4q-bar> exotic components via perturbative one gluon emission plus pair creation. It is concluded that this mechanism is not capable of producing hadronic couplings as large as they are observed to be.

8819 **Quantum chromodynamics and the nucleon longitudinal structure function.** Coulson, S.N. Southampton, England; Southampton University (1981). 222p. British Library, Boston Spa, Wetherby, West Yorks. No. D43874/82.

The phenomenon of asymptotic freedom together with the theoretical tools of the operator product expansion and renormalisation group allow a systematic and reliable application of perturbative quantum chromodynamics (Q.C.D.) to deep inelastic lepton-hadron scattering. Leading order Q.C.D. predictions for the ratio of the longitudinal to transverse cross-section, R are concluded not to give a satisfactory description of the current data at large X > 0.3. Here this perturbative analysis is extended to include the next to leading order, Q.C.D. contributions. This involves calculating the fourth order contribution to the flavour non-singlet longitudinal coefficient function that appears in the light cone expansion. A technique that regulates the spurious mass-singularities encountered in a consistent manner is discussed, and its use justified through examples utilising the optical theorem. The Q.C.D. expression for the moments of the flavour non-singlet longitudinal structure function is then inverted using a simple technique, allowing a plot of the next to leading order Q.C.D. corrections to the ratio R. Such cor-

rections are found to be small (approximately 12% for X>0.5) and it is concluded that to this order of perturbation theory a discrepancy between theory and experiment still exists.

8820 **Some hard photon induced processes in QCD.** Kang, I. Oxford, England; Oxford University (1981). 94p. British Library, Boston Spa, Wetherby, West Yorks. No. D45041/83.

Perturbative QCD is applied to various hadronic processes initiated by hard photons which enjoy the rare status of being exactly predictable to leading order in asub(s). The photon and nucleon structure functions are first introduced and the photon structure function is calculated in Born approximation as an example, including the mass finite piece. The cross sections are then calculated for $\gamma N \to \mu\mu\text{-bar}X$, $\gamma N \to (\text{jet})\ X$ and $\gamma N \to \pi^+ X$ using the distribution functions for quarks in the photon predicted by QCD. Photon-photon scattering is next considered, the main objective being to gain an insight into the convergence properties of QCD by computing the $\sigma\Xi(\alpha\text{sub}(S))$ corrections to $\gamma\gamma \to 2$ jets. Various cross sections are then considered in an effort to find the most suitable quantity for the non-leading order calculation. The Sterman-Weinberg jet measure is chosen and the $O(\alpha\text{sub}(S))$ correction to this quantity is calculated using the dimensional regularization scheme to regulate the infrared and mass singularities. The calculation is then repeated using the very recently proposed technique of dimensional reduction which is a variant of ordinary dimensional regularization.

8821 **Measurement of the total and differential cross sections for the charged-current interactions of neutrinos with protons.** Giles, R.T. Oxford, England; Oxford University (1981). 172p. British Library, Boston Spa, Wetherby, West Yorks. No. D44201/83.

The total charged-current neutrino-proton cross section $\sigma\Xi\text{sup(upsilon)}P$ was found to rise linearly with neutrino energy E over the energy range $20<E<180$GeV and the average value of $\sigma\Xi\text{sup(upsilon)}P/E$ was measured. The events were found to have an approximately flat distribution in Bjorken y. $F_3\text{sup(upsilon)}P(x,Q^2)$ was extracted from the data under the assumption that $2xF_1=F_2=xF_3$; this should be valid for Bjorken $x>0.25$. The measurements of $F_3\text{sup(epsilon)}P$ show scaling violations which are consistent with the predictions of QCD perturbation theory, the QCD parameter Λ was found to be 0.35 +- 0.30GeV. It is found that $\sigma\Xi\text{sup(upsilonn)}/\sigma\Xi\text{sup(upsilon)}P = 2.05+\text{-}0.34$. This is consistent with the prediction of the quark-parton model and with other experimental measurements of this quantity. The ratio is independent of Q^2 but decreases with increasing Bjorken x; this implies that the quark density ratio d/u decreases as x increases, and a similar trend has been inferred from the results of other experiments.

8822 **Quantum chromodynamics and deep inelastic scattering.** Ecclestone, R.E. Southampton, England; Southampton University ([nd]). 121p. British Library, Boston Spa, Wetherby, West Yorks. No. D43875/82.

The formalism involved in relating QCD calculations to experimental results in the deep inelastic region is discussed and then a high-order QCD calculation is presented - the two-loop corrections to the Wilson coefficients of the moments of the longitudinal structure function (for the non-singlet case). The calculations have been made using massless quarks, and infra-red divergences are regulated by keeping incoming and outgoing quarks slightly off mass-shell. Analytic results have been obtained for all but two of the diagrams calculated. Results are presented for three, four, five and six quark flavours, and for both the MS and M-barS-bar renormalization schemes.

6453 Particle Invariance Principles And Symmetries

8823 **(FERMILAB/TM—1144) Double proton beam for E-621.** Thomson, G.B. (Fermi National Accelerator Lab., Batavia, IL (USA); Rutgers--the State Univ., New Brunswick, NJ (USA)). Oct 1982. Contract AC02-76CH03000. 11p. NTIS, PC A02/MF A01. Order Number DE84003609.

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For experiment 621 we plan to modify the transport system of the Proton-center beam to create two side-by-side proton beams separated by two inches. This Technical Memo describes how we plan to do this, and the results we hope to attain.

8824 **(JINR—R-2-82-271) Exact solutions of the quasipotential equations for some analogs of the confining potentials.** Kapshaj, V.N.; Kuleshov, S.P.; Skachkov, N.B. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1982. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704052.

In the framework of the quasipotential approach relativistic generalizations are considered for widely used in the meson spectroscopy phenomenological confining potentials. Exact relativistic wave functions and conditions of energy level quantization are found in the momentum representation for singular at p vector = k vector quasipotentials of the following type V approximately d^3/dk^3 vector x delta (p vector - k vector)$^{-4}$, V approximately (p vector - k vector)$^{-4}$. The energy spectrum of the quasipotential equation for spin particles is compared with the experimental mass spectrum for phisub(-), Y- and rho-mesons.

8825 **(LAPP-T—82-01) General treatment of a non-linear gauge condition.** Malleville, C. (Grenoble-1 Univ., 74 - Annecy (France). Lab. de Physique des Particules; Grenoble-1 Univ., 38 (France)). Jun 1982. 68p. (In French). NTIS (US Sales Only), PC A04/MF A01. Order Number DE83704054.

A non linear gauge condition is presented in the frame of a non abelian gauge theory broken with the Higgs mechanism. It is shown that this condition already introduced for the standard SU(2) x U(1) model can be generalized for any gauge model with the same type of simplification, namely the suppression of any coupling of the form: massless gauge boson, massive gauge boson, unphysical Higgs.

8826 **(LYCEN—8306) Generating function of unitary group isoscalar factors.** Hassan, M.H. (Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire). Feb 1983. 13p. (In French). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750232.

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In this paper we introduce a new schematization of the elements of the unitary group fundamental representation basis. Using this schematization as well as two rules which will be establish in this work, we were able to find by an elementary calculus, the generating function of the Gel'fand basis of unitary group, and the generating function of coupling coefficients. This last generating function permits us to find the one corresponding to SU(n) isoscalar factors. Our approach is the only one which gives in the general case, i.e., for every n, an explicit expression of these factors. We show how to find the elements of the irreducible representation of the direct product of N representations, and we give the details of this method in the special case n = 2. A priori, our method can be easily applied to other classical groups.

8827 **Addendum to "Grand unification of preon models".** Rizzo, T.G. (Ames Laboratory and Department of Physics, Iowa State University, Ames, Iowa 50011). *Physical Review [Section] D: Particles and Fields*; **28**: No. 11, 2892-2894(1 Dec 1983). Contract W-7405-ENG-82.

We extend the discussion of our previous work and investigate the possibility of low-energy parity restoration, i.e., the left-right-symmetric model, within the context of several preon theories of grand unification. The constraints imposed by unification, proton lifetime, and neutral-current data are discussed.

6454 Field Theory

REFER ALSO TO CITATION(S) 8777, 8786, 8797, 8815, 8827

8828 **(BNL—33824) Mean field theory of the linear σ-model: chiral solitons.** Kahana, S.; Ripka, G. (Brookhaven National Lab., Upton, NY (USA); CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique Theorique). 1983. Contract AC02-76CH00016. 17p. (CONF-831065—1). NTIS, PC A02/MF A01. Order Number DE84002864.

From Meeting of the Nuclear Physics Division of the American Physical Society; Notre Dame, IN, USA (13 Oct 1983).

The mean field theory of the chiral invariant σ-model is outlined. bound states (solitons) of valence quarks are obtained self-consistently using a hedgehog shape for the pion field. A schematic model for the coupled fermion-boson fields is presented. Renormalization is worked out for the fermion one-loop corrections and numerical results presented for the purely scalar-field case. The interpretation of the baryon number of the perturbed vacuum is considered.

8829 **(LAPP-TH—71) Topological structure of the vacuum in SU(2) and SU(3) lattice gauge theories.** Ishikawa, K.; Schierholz, G.; Schneider, H.; Teper, M. (Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires). Jan 1983. 15p. (DESY—83-006). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750234.

We present Monte Carlo measurements of the net topological charge of the vacuum in SU(2) and SU(3) lattice gauge theories. In both cases there is no evidence of any topological structure. Moreover we find a strong sensitivity to the lattice size and to the boundary conditions imposed on the lattice. We comment on the physical significance of these results, establish criteria for the reliable performance of such calculations, and remark on the possibly detrimental impact of these findings on the calculation of hadron spectra.

8830 **'Q.C.D., colours, flavours and symmetries'.** Christos, G.A. Oxford, England; Oxford University (1981). 200p. British Library, Boston Spa, Wetherby, West Yorks. No. D44174/83.

Some aspects of Quantum Chromodynamics are considered including; the 1/N expansion, where N is the number of colours, U(L) x U(L) chiral symmetry, where L is the number of flavours, and, the U(1) problem.

6455 Scattering Theory

REFER ALSO TO CITATION(S) 8819, 8822

8831 **(LYCEN—8303) Construction of diffractive amplitudes.** Giffon, M.; Hama, Y.; Predazzi, E. (Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire). Jan 1983. 15p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750230.

Starting from a simple parametrization of production amplitudes an explicit construction of the diffractive elastic amplitude through multiparticle unitarity is given. It is shown that the phase cancellation effect is essential in order to obtain an elastic amplitude which displays a diffractive peak in qualitative agreement with the data.

65 PHYSICS. II.

6510 Nuclear Physics

REFER ALSO TO CITATION(S) 7695, 8686, 9049

8832 **(DOE/ER/03624—24) Triangle Universities Nuclear Laboratory. Annual report - TUNL XXII, 1 September 1982-31 August 1983.** (Duke Univ., Durham, NC (USA); North Carolina Univ., Chapel Hill (USA); North Carolina State Univ., Raleigh (USA)). 1983. Contract AS05-76ER03624;AC05-76ER01067. 168p. NTIS, PC A08/MF A01. Order Number DE84004720.

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At TUNL particular emphasis is placed on reactions induced by polarized protons, deuterons, and neutrons. We also continue a major commitment to the study of the statistical properties of nuclear structure revealed by elastic and inelastic scattering experiments using ultra high resolution beams. A third major laboratory commitment involves measurements of fast neutron cross sections required by the Department of Energy's program for the development of controlled thermonuclear fusion. The major accelerator facilities of the laboratory include a model FN tandem Van de Graaff accelerator and a 15 MeV fixed-energy negative ion cyclotron injector. These accelerators coupled together, constituted the world's first Cyclo-Graaff. The laboratory has two additional single ended Van de Graaff accelerators with terminal voltages of 4 MV. The ungraded K machine, with its associated equipment, provides intense beams of very high energy resolution. The older 4 MV accelerator is now enjoying renewed research usefulness in a program funded by the National Science Foundation for the study of plant processes utilizing ^{11}C as a tracer. Research and development progress is detailed. Publications are listed. (WHK)

8833 **(INIS-mf—8299) Max-Planck-Institut fuer Kernphysik: Annual report 1982.** (Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.)). 1983. 241p. (In German). NTIS (US Sales Only), PC A11/MF A01. Order Number DE84780049.

Abstracts of individual items from the report were prepared separately for the data base.

8834 **(INIS-mf—8307) Gross properties of nuclei and nuclear excitation. Proceedings.** (Technische Hochschule Darmstadt (Germany, F.R.). Inst. fuer Kernphysik; Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). 1983. 228p. (CONF-830118—). NTIS (US Sales Only), PC A11/MF A01. Order Number DE84780052.

From 11. international workshop on gross properties of nuclei and nuclear excitations; Hirschegg, Austria (17 Jan 1983).

The papers presented were entered into the data base separately. (WHK)

8835 **(ISN—82-18) Annual report 1981.** (Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires). 1982. 122p. (In French). NTIS (US Sales Only), PC A06/MF A01. Order Number DE83704072.

This progress report reviews the research activities in the Institute of Nuclear Sciences for the year 1981; in experimental nuclear physics: nuclear spectroscopy, giant resonances, reaction processes, weak interactions, perinuclear research. In nuclear theory, studies were carried out on nuclear structure, nuclear reactions and the 3 quarks bound states problem. The setting-up of Sara facilities was going on the whole year through and the first beams are now accelerated.

8836 **(ORNL—6004) Physics Division progress report for period ending September 30, 1983.** (Oak Ridge National Lab., TN (USA)). Dec 1983. Contract W-7405-ENG-26. 378p. NTIS, PC A17/MF AO1. Order Number DE84004127.

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Research and development activities are summarized in the following areas: Holifield Heavy Ion Research Facility, nuclear physics, the UNISOR program, accelerator-based atomic physics, theoretical physics, nuclear science applications, atomic physics and plasma diagnostics for fusion program, high-energy physics, the nuclear data project, and the relativistic heavy-ion collider study. Publications and papers presented are listed. (WHK)

6512 Nuclear Properties And Reactions, A=1-5, Theoretical

8837 (INIS-mf—8299, pp 156) **Model for multiplicity distributions in hadron-nucleon and α-α interactions at very high energies.** Chao, W.Q. (Academia Sinica, Beijing (China). Inst. of High Energy Physics); Pirner, H.J. 1983. NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

8838 (INIS-mf—8299, pp 156) **Coherent π^- production in He^3.** Hiller, B.; Pirner, H.J. 1983. NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

8839 (INIS-mf—8299, pp 145-148) **Experiments with alpha particles at the CERN pp storage rings.** Bell, W.; Drijard, D.; Fischer, H.G.; Frehse, H.; Geist, W.; Hanke, P.; Innocenti, P.G.; Mornacchi, G.; Ullaland, O. (European Organization for Nuclear Research, Geneva (Switzerland)); Claesson, G. 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphyik: Annual report 1982.

Results obtained so far from the experiment with α particles in the CERN intersecting storage rings are reviewed. Surprises have been provided by the high yield of hadrons at large transverse momenta, the low elastic cross section at large momentum transfers, and high secondary particle densities in the central rapidity region in αα collisions.

8840 (INIS-mf—8307, pp 119-131) **Light ions and high energy nuclear physics.** Szwed, R. (Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.)). 1983. NTIS (US Sales Only), PC A11/MF A01. (CONF-830118—).

From 11. international workshop on gross properties of nuclei and nuclear excitations; Hirschegg, Austria (17 Jan 1983).

New results from the α-α and α-p experiments at the CERN Intersecting Storage Rings (ISR) as well as from experiments with light ions at lower energies will be presented and their impact on our understanding of multiparticle production processes at large cross-sections will be discussed. The evidence for "exotic" small-cross-section phenomena observed in high energy nuclear experiments will be reviewed. The possibilities for new experiments at CERN with light ions on a fixed target including searches for multibaryon resonances and multiquark states will be mentioned.

8841 (INIS-mf—8664, pp 74) **Elastic electron-deuteron scattering.** Schwarz, K.; Zingl, H.F.K.; Mathelitsch, L. (Graz Univ. (Austria). Inst. fuer Theoretische Physik). 1982. (In German). NTIS (US Sales Only), PC A05/MF A01. (CONF-8209185—).

From Annual conference of the Austrian Physical Society; Graz, Austria (22 Sep 1982).

Published in summary form only.

8842 (INIS-mf—8664, pp 75) **Mass difference corrections in the pionic hydrogen atom.** Thaler, J.; Zingl, H.F.K. (Graz Univ. (Austria). Inst. fuer Theoretische Physik). 1982. (In German). NTIS (US Sales Only), PC A05/MF A01. (CONF-8209185—).

From Annual conference of the Austrian Physical Society; Graz, Austria (22 Sep 1982).

Published in summary form only.

8843 (INIS-mf—8664, pp 76) **Chargy symmetry prediction of p-d measureable quantities.** Zankel, H. (Graz Univ. (Austria). Inst. fuer Theoretische Physik). 1982. (In German). NTIS (US Sales Only), PC A05/MF A01. (CONF-8209185—).

From Annual conference of the Austrian Physical Society; Graz, Austria (22 Sep 1982).

Published in summary form only.

8844 (INIS-mf—8664, pp 71) **Hyperfine effects in the resonant formation of muonic D_2^+ molecules.** Breunlich, W.H.; Cargnelli, M.; Fuhrmann, H.; Kammel, P.; Mahler, H.G.; Marton, H.; Pawlek, P.; Strehl, T.; Werner, J.; Zmeskal, J. (Oesterreichische Akademie der Wissenschaften, Vienna). 1982. (In German). NTIS (US Sales Only), PC A05/MF A01. (CONF-8209185—).

From Annual conference of the Austrian Physical Society; Graz, Austria (22 Sep 1982).

Published in summary form only.

8845 (IPNO-TH—82-47) **Note on the mesonic exchange effects in the $\gamma d \to \pi^0 d$ reaction.** Lazard, C.; Maric, Z. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). Oct 1982. 12p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704071.

The mesonic exchange current contributions for the $\gamma d \to \pi^0 d$ reaction are studied by using the model in which this effect is described by the elementary amplitude of a double pion photoproduction on a nucleon, one of them being soft and absorbed by the other nucleon. The interference effects with the impulse and pion rescattering terms are also calculated. It is found that at the (3-3) resonance energy, the whole contribution is between 5 and 10% at the backwards angles.

8846 (ISN—82-25) **Measurement of the total reaction cross section for interactions between heavy ions (application to the system $^{12}C+^{12}C$ at 112MeV).** Cherkaoui-Tadili, R. (Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires; Grenoble-1 Univ., 38 (France)). 1982. 91p. (In French). NTIS (US Sales Only), MF A01. Order Number DE84750223.

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The total reaction cross-section σsub(R) for interactions between heavy ions is predicted to decrease rapidly with the energy of the incident projectile over the energy range 10 MeV/A - 100 MeV/A. We present here an experimental met σsub(R) to test the model based predictions. The method consists in counting the number of all incoming projectiles and the number of out going projectiles that did not interact with the target. The difference between these two numbers corresponds to the number of particles that reacted with the target nuclei and is therefore proportional to σsub(R). Values of σsub(R) have been measured for the system $^{12}C + ^{12}C$ at two incident energies of 112 MeV and 996 MeV. The results of 1444 +- 70 (112 MeV) and 994 +- 50 (996 MeV) show a total reaction cross-section decreasing with energy as predicted from the Glauber model and optical model fits to elastic scattering.

8847 **Low-energy charged-particle fusion reactions.** Hardekopf, R.A.; Brown, R.E.; Clark, D.A.; Correll, F.D.; Jarmie, N. (Los Alamos Scientific Laboratory, Los Alamos, NM 87545). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 2, 1339-1343(Apr 1981). (CONF-801111—).

From 6. conference on application of accelerators in research and industry; Denton, TX, USA (3 Nov 1980).

The authors have initiated a program at Los Alamos to measure cross sections for the charged-particle reactions $D(t,n)^4He$, $T(t,2n)^4He$, $D(d,n)^3He$, and $D(d,p)T$ that are fundamental to the understanding of controlled thermonuclear fusion. Interest in these processes is primarily in the region below 100-keV bombarding energy, and accordingly the design range for the measurements is 10-120 keV. The authors' desired accuracy is 5% or less, compared with present systematic uncertainties of up to 50%. The experiment features a negative ion source and highly stable injector for the

low-energy beam, measurement of beam intensity with a precision calorimeter, a windowless cryogenic target, calibration of the target density with a high-energy Van-deGraaff beam, and a time-of-flight laser spectrometer to determine the absolute energy. Preliminary data have been obtained on the d + d reactions while preparations are underway for introducing tritium into the system.

6513 Nuclear Properties And Reactions, A=6-19 Theoretical

8848 **(CEA-CONF—6632) Subthreshold $\pi^+\pi^-$ production in heavy ion collisions.** Poitou, Jean. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Jan 1983. 21p. (CONF-830117—13). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704080.

From 21. international winter meeting on nuclear physics; Bormio, Italy (24 Jan 1983).

The $\pi^+\pi^-$ production far below the N-N collision production threshold has been investigated with the ^{12}C beam from the CERN SC and different targets. The results are compared with the prediction of a first N-N collision model. A reasonable agreement is obtained for the $^{12}C+^{12}C$ π^+ data at 86 MeV/A. For other targets, the agreement is poor. Systematic deviations are found even with the $^{12}C+^{12}C$ system at low pion energy. The target dependence of the π^+ versus π^- production cross section is rather surprising. No explanation for it has been found.

8849 **(CEA-N—2320) Study of (p-π) reactions at intermediate energies.** Couvert, Pierre. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France); Paris-11 Univ., 91 - Orsay (France)). Feb 1983. 250p. (In French). NTIS (US Sales Only), PC A11/MF A01. Order Number DE83704081.

This thesis presents all the A(p,π^{+-})A+1 experimental data measured at Saturne since 1974. A theoretical analysis of a few of them is made in the frame of a microscopic two-nucleon model, involving an intermediate $\Delta(1232)$ resonance excitation. The spectrometer SPES I and the focal plane detection system are rapidly described. The data analysis method is presented in details. Calculations of the $^{10}B(p,\pi^+)^{11}B$ (G.S.) excitation functions at constant transfer momentum lead to a good qualitative agreement in a wide range of incident energy and momentum transfer. This model also reproduces the $^{12}C(p,\pi^-)^{13}O$(G.S.) experimental cross sections at 613 MeV, pointing out the importance of the N(1520) resonance contribution to the (p,π^-) reaction mechanism above the (3,3) resonance.

8850 **(CENBG—8223) Search on the parity forbidden α-width of the Esub(x)=4.753 MeV (Jsup(π), T=0^+,1) level of ^{18}F.** Hubert, P.; Leccia, F.; Mennrath, P.; Morales, A.; Morales, J.; Nunez-Lagos, R. Plo, M. (Bordeaux-1 Univ., 33 - Gradignan (France). Centre d'Etudes Nucleaires). 1983. 6p. (CONF-820991—4). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750235.

From 8. international workshop on weak interactions and neutrinos; Javea, Spain (5 Sep 1982).

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8851 **(DOE/ER/10714—3) Nuclear physics research. Progress report, April 1, 1983-March 31, 1984.** Mateja, J.F. (Tennessee Technological Univ., Cookeville (USA). Dept. of Physics). 1983. Contract AS05-80ER10714. 76p. NTIS, PC A05/MF A01. Order Number DE84004908.

Progress is reported on the following studies: $^{10}B + ^{13}C$ and $^{11}B + ^{12}C$ fusion cross sections from 40 to 100 MeV, fusion cross sections for four heavy-ion entrance channels leading to the ^{23}Na compound nucleus, and heavy ion resonances. (WHK)

8852 **(EFI—525(12)-82) Factorization of structure function in the process of photoproduction of cumulative protons.** Egiyan, K.Sh. (Erevanskij Fizicheskij Inst. (USSR)). 1982. 11p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704082.

Experimental results on the photoproduction of cumulative protons on ^{12}C are presented versus the light scaling variable α and Psub(perpendicular). The structure function f(α, Psub(perpendicular)sup(2)) is shown to be factorized for $\alpha > 1$ and Psub(perpendicular) >= 0.5 GeV/c; f(α, Psub(perpendicular)sup(2))=fsub(1)(α)x fsub(2)(Psub(perpendicular)sup(2)). The functions $f_1(\alpha)$ and fsub(2)(Psub(perpendicular)sup(2)) here have an exponential form.

8853 **(INIS-mf—8299, pp 112-114) Study of the reaction $^{12}C(d,\alpha)^{10}B$ and spectroscopy of ^{10}B.** Kariem, S.A.; Rohwer, T.; Staudt, G. (Tuebingen Univ. (Germany, F.R.). Physikalisches Inst.); Klapdor, H.V. 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphyik: Annual report 1982.

The $^{12}C(d,\alpha)^{10}B$ reaction was measured at Esub(d) = 24 MeV. The particles were detected with the multigap magnetic spectrograph. The differential cross sections of transitions populating positive parity states in ^{10}B are compared with DWBA predictions for the two-nucleon pickup. For some excited states the isospin value T = 0 has been established; in other cases the excitation mechanism and possible spin values are discussed.

8854 **(INIS-mf—8299, pp 122-123) Experiments with the sodium beam of the MP tandem.** Becker, K.; Blatt, K.; Fick, D.; Gemmeke, H.; Jaensch, H.; Luh, L. (Marburg Univ. (Germany, F.R.). Fachbereich Physik); Caplar, R. (Institut Rudjer Boskovic, Zagreb (Yugoslavia)); Karban, O. (Birmingham Univ. (UK)); Butsch, R.; Heck, B. 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphyik: Annual report 1982.

First experiments, mainly on the fusion of ^{22}Na with ^{12}C and ^{23}Na have been performed with the new ^{23}Na beam at the MP tandem.

8855 **(INIS-mf—8299, pp 125-126) Neutron-proton correlations from deuteron breakup on gold at Esub(d)=15 MeV.** Seligmann, B.; Ernst, J.; Kleinfeller, J. (Bonn Univ. (Germany, F.R.). Inst. fuer Strahlen- und Kernphysik); Gemmeke, H. (Marburg Univ. (Germany, F.R.). Fachbereich Physik; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.)); Keller, K.; Lassen, L.; Luecking, W.; Schreck, R. 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphyik: Annual report 1982.

Recent inclusive measurements of d-breakup showed an excess yield (1-2 order of magnitude) of low-energy protons for heavy target nuclei (A > 93), as compared to theory. In order to clarify this discrepancy exclusive n-p correlations have been taken for 15 MeV d + ^{12}C, ^{197}Au. First results indicate that d-breakup from target impurities (H,C) strongly contributes to the production of low-energy protons.

8856 **(INIS-mf—8299, pp 126-127) Search for collective γ transitions in the quasimolecular system $^{12}C+^{12}C$.** Adelberger, E. (Washington Univ., Seattle (USA). Nuclear Physics Lab.); Albrecht, R.; Kolb, B.; Simon, R.S. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)); Fischer, R.D.; Kuehn, W.; Muehlhans, R.; Metag, V. (Giessen Univ. (Germany, F.R.). 2. Physikalisches Inst.); Habs, D.; Helmer, K. 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphyik: Annual report 1982.

Using the crystal ball we have searched for the γ decay of the resonance at Esub(CM) = 25.6 MeV. An upper limit (3 standard deviations) of (GAMMAsub(γ)/GAMMAsub(tot)) < 8×10^{-7} is found which is more than one order of magnitude lower than the branching rate of 2×10^{-5} expected in the case of a strongly deformed but short-lived ^{24}Mg nucleus formed in the scattering.

8857 **(INIS-mf—8299, pp 127-128) High-spin resonances in the two-nucleon transfer reaction $^{10}B(^{14}N,^{12}C)^{12}C$.** Klauss, E.; Drevermann, J.; Isenbuegel, R.; Hoppe, W.; Mueller, H.R.; Sprengel, D.; Marquardt, N. (Bochum Univ. (Germany, F.R.). Inst. fuer Experimentalphysik); Wiedner, C.A.; Gyufko, R. 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphyik: Annual report 1982.

Excitation functions of the two-nucleon transfer reaction $^{10}B(^{14}N, ^{12}C)^{12}C$ have been measured from Esub(CM) 0 5-32 MeV, corresponding to ^{24}Mg excitation energies from 34-61 MeV. Striking resonant structures are observed at small angles near Esub(x)(^{24}Mg) = 45 and 53 MeV wich correlate with the pronounced resonances in the $^{12}C + ^{12}C$ inelastic channels of possible Jsup(π) values 16^+ and 18^+.

8858 (INIS-mf—8299, pp 128) **Comparison of $^{10}B(^{14}N,\alpha)^{20}Ne$ and $^{12}C(^{12}C,\alpha)^{20}Ne$ angular distributions near the 14^+ resonance at Esub(x)(^{24}Mg)=39 MeV.** Hoppe, W.; Drevermann, J.; Isenbuegel, R.; Klauss, E.; Mueller, H.R.; Sprengel, D.; Marquardt, N. (Bochum Univ. (Germany, F.R.). Inst. fuer Experimentalphysik); Wiedner, C.A.; Gyufko, R. 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphyik: Annual report 1982.

A detailed comparison of angular distributions of the $^{10}B(^{14}N,\alpha)$ and $^{12}C(^{12}C, \alpha)$ reactions has been performed near the 39 MeV resonance. In an attempt to determine the spin of the resonance, which appears to be correlated in both different reactions, Hauser-Feshbach statistical model calculations have also been performed. Preliminary results are presented.

8859 (INIS-mf—8299, pp 129) **d-α correlations in the $^{12}C(^6Li,d\alpha)^{12}C$ and $^{16}O(^6LI,d\alpha)$ reactions.** Wolski, R.; Szmider, J. (Institute of Nuclear Physics, Krakow (Poland)); Ho, H.; Kato, N.; Moebius, K.; Wurm, J.P. 1983. NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphyik: Annual report 1982.

8860 (INIS-mf—8299, pp 141-142) **Experiments with low energy pions at the QQD magnetic spectrometer in Vancouver (TRIUMF).** Barnett, B.; Gill, D.; Gyles, W.; Johnson, R.R.; Tacik, R. (British Columbia Univ., Vancouver (Canada)); Drake, T.; Sobie, R. (Toronto Univ., Ontario (Canada)); Martin, S. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Kernphysik); Wiedner, C.A. 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphyik: Annual report 1982.

The optical parameters of the M13 beamline and the QQD spectrometer have been determined, with the result that some unstable power supplies cause a momentum uncertainty of +- 1% of the beam. First measurements of elastic-scattered π^+ on the isotopes ^{12}C, ^{14}N, sup(16,18)O show good agreement of the charge rms radii with those determined with electron scattering, X-ray spectroscopy and μ capture.

8861 (INIS-mf—8299, pp 142-144) **Production of Σ hypernuclei.** Bertini, R.; Birien, P.; Bruge, G.; Catz, H.; Chaumeaux, A.; Durand, J.M.; Garreta, D.; Janouin, S.; Mayer, B.; Saudinos, J. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphyik: Annual report 1982.

A puzzling result in the field of hadronic interactions is the existence of Σ hypernuclei. The experiment at the CERN proton synchrotron which for the first time has systematically investigated these exceptional nuclei is described. The question arises whether other strongly interacting particles can be stable in nuclear matter under identical, equal conditions.

8862 (INIS-mf—8307, pp 205-208) **Proximity complex heavy ion optical potential.** Sartor, R.; Stancu, F. (Liege Univ. (Belgium). Inst. de Physique). 1983. NTIS (US Sales Only), PC A11/MF A01. (CONF-830118—).

From 11. international workshop on gross properties of nuclei and nuclear excitations; Hirschegg, Austria (17 Jan 1983).

The authors have studied the proximity concept for the imaginary part of the optical potential for heavy ion reactions. This part is calculated for the $^{16}O+^{16}O$ system at Esub(lab) = 83 MeV.

8863 (INIS-mf—8307, pp 65-70) **Possible cooperative effects observed in the neutral pion production from nucleus nucleus collisions.** Grosse, E. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). 1983. NTIS (US Sales Only), PC A11/MF A01. (CONF-830118—).

From 11. international workshop on gross properties of nuclei and nuclear excitations; Hirschegg, Austria (17 Jan 1983).

The author has measured the inclusive spectra of neutral pions produced in ^{12}C reactions at 60, 74, and 84 MeV/u on targets of C, Al, Ti, Ni, Sn, Ta, Pb, and U.

8864 (INIS-mf—8307, pp 173-177) **Structure in the beta-delayed neutron spectrum of ^9Li.** Nyman, G.; Mattsson, S. (Chalmers Tekniska Hoegskola, Goeteborg (Sweden). Dept. of Physics); Azuma, R.E. (Toronto Univ., Ontario (Canada). Dept. of Physics); Jonson, B. (European Organization for Nuclear Research, Geneva (Switzerland). ISOLDE Collaboration); Kratz, K.L.; Ziegert, W. (Mainz Univ. (Germany, F.R.). Inst. fuer Kernchemie); Larsson, P.O. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). 1983. NTIS (US Sales Only), PC A11/MF A01. (CONF-830118—).

From 11. international workshop on gross properties of nuclei and nuclear excitations; Hirschegg, Austria (17 Jan 1983).

The decay properties of the light nucleus ^9Li have been studied in measurements of beta-delayed neutrons and alpha particles. The acitivity was produced at the ISOLDE facility in fragmentation reactions induced either by 600 MeV proton or 910 MeV ^3He beams from the CERN Synchro-cyclotron. After mass separation, neutron spectra were recorded using either ^3He-filled proportional counters or by using time-of-flight techniques. Surface barrier detectors were used for the spectroscopy of alpha particles.

8865 (ISN—82-35) **^{12}C-^{12}C total and reaction cross-section between 6 and 85 MeV/A from an optical model analysis.** Brandan, M.E. (Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires). Jul 1982. 18p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704073.

Values of σsub(R) and σsub(T) are obtained from an optical model analysis of ^{12}C-^{12}C elastic scattering data between 6 and 85 MeV/A. They confirm the general trends predicted by DeVries and collaborators but show discrepancies at the region of the maxima. The o.m. analysis indicates a significant decrease of the real potential strength with energy.

8866 (ITEF—136(1982)) **Deuteron production under angle of 100 deg on the ^{12}C, ^{16}O, Cu, Pb nuclei in the $\pi^-A \rightarrow dx$ inclusive reactions at 1.5 GeV/c π^- meson.** Buklei, A.E.; Burgov, N.A.; Vlasov, M.K. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1982. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704088.

Data on energy spectra of deuterons escaping ^{12}C, ^{16}O, Cu, Pb nuclei in the angle range of 100 deg +- 5 deg (l.s.) the $\pi^-A \rightarrow$ dX inclusive reactions at 1,5 GeV/c of incident pions are presented. Experimental results obtained and predictions of attachment models were compared.

8867 (JINR—R-2-82-200) **Electromagnetic corrections to Compton effect on π-meson.** Akhundov, A.A.; Bardin, D.Yu.; Mitsel'makher, G.V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1982. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704050.

The electromagnetic corrections to the process of radiative scattering of high energy pions by nuclear Coulomb field are calculated. It is shown that the account of these corrections is important in an extraction of the pion polarizability value from the experimental data.

8868 **Effects of a nuclear scattering resonance on bremsstrahlung production and K-shell ionization.** Trail, C.C.; Lesser, P.M.S.; Liou, M.K. (Brooklyn Coll. of CUNY, Brooklyn, NY 11210). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **30**: No. 2, 1124-1127(Apr 1983). Contract AC02-81ER40023.

While the effects of nuclear resonances on nuclear bremsstrahlung emission have been the focus of current bremsstrahlung studies in nuclear physics, such effects on atomic K-shell ionization have attracted much attention recently. In this paper, the authors review the recent developments of these two topics with the emphasis upon their common features. Special attention is given to the effect of the nuclear resonance near 461 keV in p+^{12}C where experimental results are available for bremsstrahlung production and K-shell ionization.

8869 **The reaction ^{6}Li(d,nγ)^{7}Be and the energy loss of low energy deutrons in matter.** Cecil, F.E.; Fahlsing, R.F.; Nelson, R.A. (Colorado School of Mines, Golden, Colorado 80401). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 2, 1286-1288(Apr 1981). (CONF-801111—). Contract AC01-80ER10643.

From 6. conference on application of accelerators in research and industry; Denton, TX, USA (3 Nov 1980).

Thick target yields for the reaction ^{6}Li(d,nY)^{7}Be have been measured using LiF and LiCl targets at deuteron bombarding energies between 48 and 170 keV. Assuming recently published values for the stopping powers of deuterons in Li and F, the LiF thick target yields were used to deduce the total cross section for the reaction, ^{6}Li(d,nY)^{7}Be. The cross section varies from about 0.3 mb at 160 keV to about .004 mb at 60 keV. A comparison between the yields measured used the LiF and LiCl targets allowed a measurement of the relative stopping powers of deuterons in F and Cl. A significant discrepancy is observed between measured values of the relative stopping powers and the predicted value of the relative stopping powers based on recently published values.

8870 **Theory of nuclear structure.** Marsh, S.M. Oxford, England; Oxford University (1981). 7p. British Library, Boston Spa, Wetherby, West Yorks. No. D45055/83.

A new method to calculate the hyperspherical functions for the quantum mechanical three-body problem is developed using the shift operators of the group SU(3) in an O(3) basis. The functions are calculated for several combinations of SU(3) and O(3) quantum numbers and are orthonormalized using the Schmidt procedure if these quantum numbers are insufficient to define the functions uniquely. SU(3) Clebsh-Gordan coefficients are also calculated. These results are used in a coupled-channel formalism to investigate the low-energy spectrum of Carbon-12 using the three alpha model and the Local Potential Approximation. Energy levels and elastic and inelastic electron scattering form factors are calculated and compared with experiment. The results are found to be sufficiently good to encourage further work with this model.

6514 Nuclear Properties And Reactions, A=20-38, Theoretical

8871 (CEA-CONF—6612) **Several applications of the DWBA diffractional model to quasi-elastic reactions induced by heavy ions.** Mermaz, M.C. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Jan 1983. 21p. (CONF-830117—9). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704076.

From 21. international winter meeting on nuclear physics; Bormio, Italy (24 Jan 1983).

Several applications of a DWBA formula due to Blair-Austern and Hahne and based on the diffractional model are presented. The large success of this formula is due to the fact that it can be considered as an excellent analytical fit of the ERF-DWBA model. The price we have to pay for this strong simplification is the lost of the spectroscopical strength. On the other hand, the dynamics of the reaction: Q and L matching are properly treated. The first application is the straightforward computation of the direct transfer cross section induced by heavy ions for discrete levels populated by a one-step process. The second application is a Regge-pole analysis of alpha transfer reaction for a zero spin system; cross section had been measured between zero and 180° center-of-mass angles and the third application is the analysis of elastic scattering with backward transfer of particles between two identical colliding cores. In these two last cases the general DWBA formula of Blair-Austern-Hahne is heavily and naturally simplified due to the fact we are dealing with zero spin system and in addition for the third case with reaction Q-value strictly equal to zero.

8872 (INIS-mf—8299, pp 150) **Isospin mixing in compound nuclei.** Richter, A. (Technische Hochschule Darmstadt (Germany, F.R.). Inst. fuer Kernphysik); Harney, H.L.; Li, J.Q.; Weidenmueller, H.A. 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

8873 (INIS-mf—8299, pp 64-66) **Fusion cross sections for ^{32}S + ^{27}Al.** Butsch, R.; Heck, B.; Hlawatsch, G.; Pochodzalla, J.; Rabe, H.J.; Rosner, G. 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

The excitation function of the system ^{32}S + ^{27}Al was completed at high incident energies. The resulting mass distributions of the evaporation residues cannot be reproduced by statistical model calculations.

8874 (INIS-mf—8299, pp 66-67) **Non-equilibrium processes in fusion reactions.** Butsch, R; Heck, B.; Hlawatsch, G.; Pochodzalla, J.; Rabe, H.J.; Rosner, G. 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

Velocities of evaporation residues, produced in several fusion reactions, were measured in order to get some information about the dynamics of the fusion process. In the reaction ^{32}S + ^{27}Al no incomplete fusion was observed; in the reaction ^{19}F + ^{40}Ca, Esub(Lab) = 216 MeV evidences for incomplete fusion were found.

8875 (INIS-mf—8299, pp 69-70) **^{32}S induced reactions at 10 MeV/u incident energy.** Betz, J.; Graef, H.; Novotny, R.; Pelte, D.; Winkler, U. 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

^{32}S-induced reactions on ^{28}Si, S, ^{40}Ca, ^{58}Ni, and ^{74}Ge targets were studied at 10 MeV/u bombarding energy employing the kinematical coincidence spectrometer. In general the data follow the expectation of a deep-inelastic plus evaporation mechanism. For example: the average amount of evaporated charge linearly increases with cm energy. But with much less intensity other processes were also identified: the emission of high-momentum particles in the direction of the momentum of the heavier reaction partner and the presence of at least three fragments with charges Z > 6 in some exit channels.

8876 (INIS-mf—8299, pp 91-92) **Decay of giant resonances in ^{24}Mg and ^{28}Si following excitation by inelastic α scattering at THETAsub(α)'=0°C.** Clausing, R.; Grabmayr, P.; Kihm, T.; Klein, R.; Knoepfle, K.T.; Schmidt, H.R.; Seegert, G.; Wagner, G.J.; Liu, Y.W.; Bogucki, P. 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

(α, α'c) coincidence studies of the decay of giant resonances have been extended to scattering angles THETAsub(α') = 0°. This minimizes knockout processes, maximizes monopole strength, and allows for model-independent extraction of branching ratios from one in-plane measurement. The experiment was performed at Texas A and M University using the 129 MeV α beam and the Enge split-pole spectrograph at THETAsub(α') = 0°. The decay products were measured in eight threefold telescopes. For Esub(x) <= 35 MeV branching ratios of GAMMAsub(p)/GAMMAsub(α) proportional 1 were found for ^{24}Mg and ^{28}Si. Most interestingly, we observe α'α angular correlations symmetric about 90° while for α'p they are forward peaked.

8877 (INIS-mf—8299, pp 94-95) **Decay of the nuclear continuum of ^{28}Si excited via inelastic ^{6}Li scattering.** Clausing, R.; Grabmayr, P.; Kihm, T.; Klein, R.; Knoepfle, K.T.; Schmidt, H.R.; Seegert, G.; Wagner, G.J.; Pugatsch, V.M. 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

^{28}Si(^{6}Li, ^{6}Li'c) coincidence experiments have been performed at an incident energy of 156 MeV in order to scrutinize the recent finding according to which one-nucleon knockout processes are the major source of the ^{6}Li-induced continuum.

8878 (INIS-mf—8299, pp 95-96) **Study of the continuum in inelastic scattering of ^{12}C on ^{28}Si.** Clausing, R.; Grabmayr, P.; Kihm, T.; Klein, R.; Knoepfle, K.T.; Schmidt, H.R.; Seegert, G.; Wagner, G.J. 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

The interesting results obtained by particle-gamma correlation measurements in α- and ^{6}Li-induced reactions on ^{28}Si have led us to extend these studies of inelastic continua to ^{12}C scattering at 174 MeV. Similar to the ^{6}Li-induced reaction we observed discrete gamma transitions in ^{27}Al and ^{24}Mg only. This is interpreted as a dominance of direct proton- or α-removal processes in inelastic ^{12}C scattering. Since the first excited state is bound in ^{12}C and unbound in ^{13}N the absence of mirror transitions in ^{27}Si shows a prevalence of pickup-breakup over knockout amplitudes.

8879 (INIS-mf—8299, pp 105-106) **Elastic electron scattering on sup(32,34,36)S.** Rychel, D.; Beuscher, G.; Emrich, H.J.; Fricke, G.; Mallot, G.; Miska, H. (Mainz Univ. (Germany, F.R.)); Gyufko, R.; Wiedner, C.A. 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphyik: Annual report 1982.

Charge distributions of the isotopes sup(32,34,36)S have been determined by elastic electron scattering. The measurements have been done at E = 120, 240, and 320 MeV, covering a momentum range of $0.5 <= q <= 2.7$ fm^{-1}, at the Mainz electron linac employing the magnetic spectrograph. Preliminary results of the charge rms radii are given.

8880 (INIS-mf—8307, pp 178-181) **Subthreshold K^--production by coherently produced PHI-mesons in heavy ion collisions.** Mueller, K.H. (Heidelberg Univ. (Germany, F.R.). Inst. fuer Theoretische Physik). 1983. NTIS (US Sales Only), PC A11/MF A01. (CONF-830118—).

From 11. international workshop on gross properties of nuclei and nuclear excitations; Hirschegg, Austria (17 Jan 1983).

The aim of this contribution is to show that the surprisingly large number of subthreshold k^--mesons might be due to coherently produced PHI-mesons during the nucleus-nucleus collision where the participant nucleons contribute cooperatively. We propose the picture that the entire nuclear matter distribution of the participant nucleons is surrounded by (virtual and real) PHI-mesons. In analogy to photon-bremsstrahlung where a deceleration of a charged current produces real photons, in our model, the deceleration of the baryonic current during the nuclear collision leads to the creation of real PHI-mesons.

8881 (INIS-mf—8307, pp 31-35) **Discovery of beta-delayed two-proton radioactivity in ^{22}Al and ^{26}p.** Cable, M.D.; Honkanen, J.; Parry, R.F.; Zhou, S.H.; Zhou, Z.Y.; Cerny, J. (California Univ., Berkeley (USA). Dept. of Chemistry; Lawrence Berkeley Lab., CA (USA)). 1983. NTIS (US Sales Only), PC A11/MF A01. (CONF-830118—).

From 11. international workshop on gross properties of nuclei and nuclear excitations; Hirschegg, Austria (17 Jan 1983).

^{22}Al(tausub(1/2) proportional 70 ms) and ^{26}P(tausub(1/2) proportional 20 ms) were produced via the (^{3}He,p4n) reaction on ^{24}Mg and ^{28}Si targets, respectively, using 110 MeV ^{3}He^{+2} beams of 3-7μA from the 88-inch Cyclotron at the Lawrence Berkeley Laboratory; the effective cross section for their observation as high energy (7-8 MeV), beta-delayed single proton emitters was proportional a few nb.

8882 (INIS-mf—8652) **High-spin states in sd-shell nuclei.** Poel, C.J. van der. (Rijksuniversiteit Utrecht (Netherlands)). 15 Sep 1982. 104p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE83704741.

A systematic picture of the structure of high-spin states in the mass range A = 29 - 41 is developed on the basis of experimental results for the nuclei ^{34}Cl, ^{36}K and ^{39}K. It is shown that for ^{34}Cl the difficulties induced by the relatively low cross section can be overcome. Combination of the data obtained from a γ-γ coincidence experiment with the ^{24}Mg + ^{12}C reaction, using the LACSS, and from threshold measurements in the ^{31}P + α reaction, establishes an unambiguous level scheme. By means of accurate angular-distribution measurements unambiguous spin and parity assignments are made to the high-spin levels. From the results a rather simple shell-model picture for the structure of the high-spin states evolves. Several authors have published experimental work on high-spin states in ^{39}K, with seriously conflicting conclusions, however, for the spin-parity assignments. The powerful coincidence set-up with the LACSS enables a discrimination between the conflicting results from the previous studies. In this way, unambiguous, model-independent, spin-parity assignments to the high-spin levels are established. Highly selective experimental methods are used to identify the high-spin states of ^{36}K. It is shown that with a pulsed beam in the reaction ^{24}Mg + ^{16}O advantage can be taken of the presence of a long-lived high-spin isomeric level in this nucleus. The gamma-decay of the isomer is extensively studied. With the pulsed beam, also some states above the isomer could be located. The subsequent use of two Compton-suppression spectrometers in a γ-γ coincidence experiment reveals a number of high-spin levels at higher excitation energies.

8883 (IPNO-DRE—83-05) **^{35}Na: a new neutron-rich sodium isotope.** Langevin, M.; Detraz, C.; Guillemaud-Mueller, D.; Mueller, A.C.; Thibault, C.; Touchard, F.; Epherre, M. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). 1983. 10p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750217.

^{35}Na produced by one-line isotope separation has been identified by the detection of β-delayed neutron emission. The measured half-life is (1.5 +- 0.5) ms.

8884 (JINR—R-15-82-519) **Spin flip in the ^{30}Si(p, p'γ)^{30}Si reaction in the energy range from 3.3 to 3.5 MeV.** Kangropol', Yu.V.; Osetinskij, G.M.; Turowezki, A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1982. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704092.

The angular and energy dependence of the probability of spin flip and of inelastic scattering cross section in the ^{30}Si(p, p'γ)^{30}Si reaction is measured in the energy range from 3.3 to 3.5 MeV in the centre of mass system of reference. The values of proton partial widths were obtained in the same system of reference for the transitions to 2^+ levels for the following resonances: Esub(p)=3.322; 3.342; 3.360; 3.387; 3.410 MeV. More precise values for spin and parity of resonances at Esub(p)=3.387 and 3.410 MeV are obtained. They are $5/2^-$ and $3/2^-$, respectively. The calculation was performed using the program taking into account the effect of neighbour resonances and background.

8885 **Single nucleon heavy ion transfer reactions on argon isotopes.** Eyre, N.J. Oxford, England; Oxford University (1981). 220p. British Library, Boston Spa, Wetherby, West Yorks. No. D45028/83.

Single nucleon transfer reactions, both pickup and stripping, on all three stable isotopes of argon - ^{36}Ar, ^{38}Ar and ^{40}Ar - have been studied using a ^{11}B projectile at a laboratory energy of 116 MeV. Using a gas target, the forward angle reaction cross-sections were measured with a telescope of silicon surface barrier detectors. The shape of the differential cross-section is discussed in terms of a semiclassical reaction analysis. An exact finite range DWBA code has been used to extract the spectroscopic factors of the strongly populated states and the spectroscopic factors are compared with those obtained using light ion transfer reactions. The excitation energies and spectroscopic factors of levels in nuclei in the mass range A=35-41 are modelled using various effective shell model in-

teractions. Both a complete sd shell space and a space incorporating parts of the sd and fp shells have been used. The results of a phenomenological modified surface delta interaction are compared with those of interactions based on the realistic interaction matrix elements of Kuo.

6515 Nuclear Properties And Reactions, A=39-58, Theoretical

8886 (CEA-CONF—6621) **Research of high energy giant resonances by inelastic scattering of 340 and 480 MeV α particles.** Bonin, B.; Alamanos, A.; Arvieux, J. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Jan 1983. 5p. (CONF-830117—12). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704079.

From 21. international winter meeting on nuclear physics; Bormio, Italy (24 Jan 1983).

Inelastic scattering of 340 and 480 MeV α particles has been measured on ^{208}Pb, ^{116}Sn and ^{58}Ni up to 60 MeV of excitation. The experimental inelastic spectra have been analyzed by means of a new global method. The repartition of multipole strength thus obtained shows the already known low energy giant resonances into more details, and displays new high energy ones.

8887 (INIS-mf—8299, pp 121-122) **Rotational model analysis of polarized ^{7}Li scattering by ^{58}Ni.** Karban, O. (Birmingham Univ. (UK)). 1983. NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphyik: Annual report 1982.

8888 (INIS-mf—8299, pp 67-69) **Fusion cross sections for ^{19}F + ^{40}Ca.** Butsch, R.; Heck, B.; Hlawatsch, G.; Pochodzalla, J.; Rabe, H.J.; Rosner, G. 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

Evaporation residue cross sections for the system ^{19}F + ^{40}Ca were measured using the time of flight technique in an energy range from Esub(Lab) = 42 MeV (Coulomb barrier) to Esub(Lab) = 114 MeV. Angular distributions and the fusion excitation function are shown and barrier parameters are determined. Simple models and systematics are discussed briefly.

8889 (INIS-mf—8299, pp 73-74) **Study of a non-equilibrium emission mechanism in deeply inelastic ^{16}O + Ni collisions.** Choudhury, R.K.; Gonthier, P.L.; Hagel, K.; Kniffen, S.; Namboodiri, M.N.; Natowitz, J.B.; Patton, R.; Simon, S. (Texas A and M Univ., College Station (USA)); Bruckner, A.; Ho, H. 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

The systematic study of nonequilibrium α emission in deeply inelastic collision has been continued. In order to trace the two non-equilibrium components - observed in the reaction of 20 MeV/n ^{16}O with Ti - to low bombarding energies two correlation experiments were performed for the system 14 MeV/n ^{16}O + Ni at the 88' cyclotron of the Texas A and M University and at the MP tandem postaccelerator of the MPI fuer Kernphysik. Both experiments are in the process of data analysis.

8890 (INIS-mf—8299, pp 74-78) **Three-body effects and the time scales of light particle emission in heavy ion collisions.** Fan, G.Y. (Academia Sinica, Lanchow (China). Inst. of Modern Physics); Wolski, R. (Institute of Nuclear Physics, Krakow (Poland)); Ho, H.; Schad, L.; Pfoh, A.; Wurm, J.P. 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

The precise and systematic measurement of angular and energy correlations of light particles from heavy ion reactions has made available a range of qualitatively new phenomena. Common for these experiments is the high nuclear excitation in dissipative heavy ion reactions at energies proportional 10 MeV/u whereby the particle emission becomes a very fast process (tau < 10^{-20} s). In two different reaction types, once in the particle decay of the highly excited compound nucleus ^{70}Ge, at the other hand in the depp inelastic reaction ^{32}S + ^{93}Nb three-body effects are observed. They manifest therein, that a third partner in the reaction behaviour modifies the spectra and angular distributions in a pronounced way because of a final-state interaction. "Anomalies" are observed and the aim is to understand these - for instance by means of Monte Carlo methods - in order to obtain from the measured shape and magnitude of the anomaly quantitative information about the temporal behaviour of the reaction. Sharpness and uniqueness of the observes signals let expect, that the results will be extensively model-independent.

8891 (INIS-mf—8299, pp 86-88) **Experiments with the 84 MeV/u ^{12}C beam at the CERN-SC.** Glasow, R.; Kampert, K.H.; Santo, R. (Muenster Univ. (Germany, F.R.)); Gobbi, A.; Hildenbrand, K.; Mueller, W.F.J.; Olmi, A.; Sann, H. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)); Bock, I.; Lynen, U. 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

Experiments with a ^{12}C beam of 84 MeV/u at the CERN-SC have been continued. Emphasis has been put on a simultaneous investigation of all possible reaction channels. In the case of an Au target more than 60% of the cross section leads to the emission of just a few protons or α particles. Fission occurs for intermediate impact parameters and the emission of medium-heavy fragments occurs for rather central collisions. This latter reaction cannot be described as a two-step process.

8892 (INIS-mf—8299, pp 88-89) **Excitation of the nuclear continuum of ^{58}Ni through inelastic electron scattering.** Clausing, R.; Grabmayr, P.; Kihm, T.; Klein, R.; Knoepfle, K.T.; Schmidt, H.R.; Seegert, G.; Wagner, G.J.; Friedrich, J.; Voegler, N. 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

The multipole decomposition of the ^{58}Ni(e,e') cross sections measured for qsub(eff) <= 1.3 fm^{-1} and Esub(x) <= 22 MeV shows good agreement with known E1 and E2 resonances but absence of strength concentrations for higher multipoles. The extension of the measurements to Esub(x) approx.= 50 MeV and qsub(eff) approx.= 2.2 fm^{-1} accordingly shows the increasing importance of quasifree scattering.

8893 (INIS-mf—8299, pp 100-101) **Measure of ground state correlations in ^{48}Ca.** Wagner, G.J. (Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.)); Glover, C.W.; Li, Q. (Indiana Univ., Bloomington (USA). Cyclotron Facility); Banks, S.M.; Spicer, B.M.; Shute, G.G.; Officer, V.C. (Melbourne Univ., Parkville (Australia)); Dollhopf, W.E. (Wittenberg Univ., Springfield, OH (USA)). 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphyik: Annual report 1982.

Using vector-polarized deuterons of 80 MeV and the QDDM spectrograph of the Indiana University Cyclotron Facility the ^{48}Ca(d vector,^{3}He) reaction was studied with an energy resolution of 50 keV. Among others a previously unknown, extremely weak fsub(7/2) transition to a state at 1.97 MeV in ^{47}K was localized with a spectroscopic factor about an order of magnitude lower than found in fsub(7/2) proton pickup from ^{40}Ca.

8894 (INIS-mf—8299, pp 120) **Identification of energy levels in ^{75}Kr.** Herath-Banda, M.A.; Ramayya, A.V.; Cleeman, L. (Vanderbilt Univ., Nashville, TN (USA). Dept. of Physics); Eberth, J.; Roth, J.; Heck, T. (Koeln Univ. (Germany, F.R.). Inst. fuer Kernphysik); Koenig, W.; Martin, B.; Bethge, K. 1983. NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphyik: Annual report 1982.

8895 (INIS-mf—8307, pp 169-172) **Quenching of Gamow-Teller resonances - a Δ-isobar effect of a background problem.** Osterfeld, F. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Kernphysik). 1983. NTIS (US Sales Only), PC A11/MF A01. (CONF-830118—).

From 11. international workshop on gross properties of nuclei and nuclear excitations; Hirschegg, Austria (17 Jan 1983).

The author has calculated the Δ-isobar effect on the total Gamow-Teller strength in the framework of a microscopic particle-hole doorway model. The calculated neutron spectra for the reactions ^{48}Ca (p,n) ^{48}Sc and ^{40}Ca (p,n) ^{48}Sc at 160 MeV and thetasub(c.m.) = 0° are presented.

8896 (INIS-mf—8307, pp 98-105) **Reactions between ^{58}Ni nuclei at 15.1 MeV/u.** Awes, T.C.; Ferguson, R.L.; Novotny, R.; Obenshain, F.E.; Plasil, F.; Rauch, V.; Young, G.R. (Oak Ridge National Lab., TN (USA)); Sann, H. (Lawrence Berkeley Lab., CA (USA); Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). 1983. NTIS (US Sales Only), PC A11/MF A01. (CONF-830118—).

From 11. international workshop on gross properties of nuclei and nuclear excitations; Hirschegg, Austria (17 Jan 1983).

In a separate study three-body fission events were observed in the case of ^{84}Kr + ^{90}Zr, ^{84}Kr + ^{166}Er, and ^{129}Xe + ^{122}Sn. In this work each event was kinematically completely determined (except for the effects of neutron emission), and it was deduced that the reaction involves two steps, with large energy losses in the first step leading to nonequilibrium fission in the second step.

8897 (INIS-mf—8307, pp 165) **Inelastic electron scattering, M1 giant resonances and the quest for subnuclear degrees of freedom.** Richter, A. (Technische Hochschule Darmstadt (Germany, F.R.). Inst. fuer Kernphysik). 1983. NTIS (US Sales Only), PC A11/MF A01. (CONF-830118—).

From 11. international workshop on gross properties of nuclei and nuclear excitations; Hirschegg, Austria (17 Jan 1983).

Published in summary form only.

8898 (INIS-mf—8307, pp 166-168) **Excitation of M1 transitions in medium heavy nuclei via the (p,p') reaction.** Djalali, C.; Marty, N.; Morlet, M.; Willis, A.; Jourdain, J.C. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire); Anantaraman, N.; Crawley, G.M.; Duffy, J.; Galonsky, A. (Michigan State Univ., East Lansing (USA). National Superconducting Cyclotron Lab.). 1983. NTIS (US Sales Only), PC A11/MF A01. (CONF-830118—).

From 11. international workshop on gross properties of nuclei and nuclear excitations; Hirschegg, Austria (17 Jan 1983).

We have taken advantage of the 200 MeV proton beam of the Orsay Synchrocyclotron and of the experimental set up which allows inelastic scattering measurements at very forward angles, to undertake a systematic study of the M1 resonances in medium heavy nuclei. In all the 26 nuclei, ranging from ^{40}Ca to ^{140}Ce, except in ^{48}Ca and ^{44}Ca, strong M1 peaks or resonances have been detected.

8899 (INIS-mf—8664, pp 79) **Phase shift analysis of elastic π^{+-} - ^{40}Ca scattering between 20 and 300 MeV.** Froehlich, J.; Pilkuhn, H.; Schlaile, H.G. (Kernforschungszentrum Karlsruhe (Germany, F.R.). Inst. fuer Theoretische Kernphysik). 1982. (In German). NTIS (US Sales Only), PC A05/MF A01. (CONF-8209185—).

From Annual conference of the Austrian Physical Society; Graz, Austria (22 Sep 1982).

Published in summary form only.

8900 (ISN—82-28) **Neutron emission from projectile-like and target-like fragments in the ^{18}O+^{48}Ti reaction at E(^{18}O)=116 MeV.** Chambon, B.; Drain, D.; Pastor, C.; Dauchy, A.; Giorni, A.; Morand, C. (Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires). Jul 1982. 21p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704085.

Angular correlations between neutrons and projectile-like fragments detected near the grazing angle were analysed by assuming two incoherent neutrons sources. One source describes slower neutrons evaporated by target-like fragments in equilibrium. The faster, forward-peaked neutrons originate from a second source strongly correlated with the projectile-like fragments with regards to velocity and direction. In some cases neutron emission may even be attributed to known neutron emitter levels in excited ejectiles.

8901 **Nuclear level densities and partition functions.** Joubert, D.P. Stellenbosch, South Africa; Stellenbosch University (1982). 104p. Registrar, Stellenbosch University, Stellenbosch, 7600, South Africa.

A method is proposed by which the nuclear state density and partition function can be calculated within the frame-work of an independent particle model of the nucleus. Only bound states are considered and this has consequence that the single-particle energy spectrum used in the calculations is finite. The resulting partition function and state density are finite over the total temperature and energy ranges respectively.

8902 **The ^{40}Ar (d,p) reaction and states in ^{41}Ar.** Bendjaballah, N.; Gadi, F.Z.; Lubain, A.G. (Centre des Sciences et de La Technologie Nucleaire BP 1017, Alger). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 2, 1292-1294(Apr 1981). (CONF-801111—).

From 6. conference on application of accelerators in research and industry; Denton, TX, USA (3 Nov 1980).

Cross-sections angular distributions for the reactions ^{40}Ar (d,p) have been measured at an incident deuteron energy of 3.5 MeV and compared with DWBA and Hauser-Feshbach (HF) calculations. Spectroscopic factors and l /SUB n/ values of orbital angular momentum neutron transferred have been deduced for most of the levels observed, namely the ground state, the 167, 516, 1035, 1354, 1869, 2398, 2695, 2733, 2890, 2949, 3010, 3285, 3327 and 3430 keV states. Three not previously reported states in ^{41}Ar have been identified at (1564 + or - 4) keV, (2360 + or - 5) keV and (3926 + or - 5) keV. The cross-sections corresponding to these states are very small in (d,p) reactions.

6516 Nuclear Properties And Reactions, A=59-89, Theoretical

8903 (CENBG—8222) **Preliminary results on neutrinoless double β decay in ^{76}Ge.** Dassie, D.; Hubert, P.; Leccia, F.; Mennrath, P.; Villard, M.M.; Morales, A.; Morales, J.; Nunez-Lagos, R. (Bordeaux-1 Univ., 33 - Gradignan (France). Centre d'Etudes Nucleaires). 1983. 6p. (CONF-820991—5-Summ.). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750236.

From 8. international workshop on weak interactions and neutrinos; Javea, Spain (5 Sep 1982).

Published in summary form only.

8904 (INIS-mf—8299, pp 107-109) **Beta strength function in ^{60}Ge and the detection of galactic neutrinos with ^{60}Ga.** Klapdor, H.V.; Metzinger, J. 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphyik: Annual report 1982.

Spectroscopy of galactic neutrinos can give information on gravitational collapses of stars. ^{60}Ga has been proposed as a possible detector for such neutrinos. The efficiency and its dependence on the incident neutrino energy which is determined by the shape of the beta strength function in ^{60}Ge is investigated.

8905 (INIS-mf—8299, pp 71-73) **Sequential emission of fast neutrons in the reaction of 7.5 through 9 MeV/u ^{16}O with ^{64}Ni.** Gemmeke, H. (Marburg Univ. (Germany, F.R.). Fachbereich Physik); Schreck, R.; Keller, K.; Lassen, L.; Luecking, W. 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

Neutron energy and angular distributions have been studied in coincidence with projectile like fragments (PLF) for quasielastic and deep inelastic collisions of ^{16}O on ^{64}Ni. Almost all of the strongly forward-directed fast neutrons originate from sequential decay of the PLF following n pickup from the target. Excited states in the emitting ejectiles (^{17}O, ^{15}C) could be identified. No significant evidence for direct (i.e., nonsequential) projectile break-up was found. The neutron yield at backward angles corresponds

to equilibrium emission from the targetlike fragment with a nuclear temperature of 0.8 MeV. This result and a comparison of n multiplicities indicate that the total excitation energy was not shared among the heavy fragments in proportion to their masses.

8906 (INIS-mf—8299, pp 96-97) **Giant dipole resonance on excited nuclear states - a test of Brink's hypothesis.** Szeflinski, Z.; Szeflinska, G.; Wilhelmi, Z.; Rzaca, T. (Warsaw Univ. (Poland). Inst. Fizyki Doswiadczalnej); Klapdor, H.V.; Andersson, E.; Metzinger, J. 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

For the first time the shape of a giant resonance built on an excited state is investigated up to its maximum - in the reaction $^{89}Y(p,\gamma_1)$, measured in the range E_1 = 2.6-11.5 MeV.

8907 (INIS-mf—8299, pp 123-125) **Polarization of the ejectiles ^{12}B from ^{11}B and ^{13}C induced reactions on Cu and Mo targets.** Takahashi, N. (Osaka Univ., Toyonaka (Japan)); Kato, N. (Kyushu Univ., Fukuoka (Japan)); Caplar, R. (Institut Rudjer Boskovic, Zagreb (Yugoslavia)); Wolski, R. (Institute of Nuclear Physics, Krakow (Poland)); Weller, A.; Ho, H.; Steffens, E. 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphyik: Annual report 1982.

Polarisation of ^{12}B has been measured for (^{13}C, ^{12}B) and (^{11}B, ^{12}B) reactions on Cu and Mo targets. Polarisation for most energetic reaction products is approximately zero for Mo(^{13}C, ^{12}B) and Cu(^{11}B, ^{12}B) reactions. Cu(^{13}C, ^{12}B) reaction on the other hand shows large positive polarisation as does the Al(^{13}C, ^{12}B). The latter behaviour of polarisation has been found in the (^{14}N, ^{12}B) reaction on a light target such as ^{27}Al for most energetic products.

8908 (INIS-mf—8299, pp 167-168) **Halflife of ^{71}Ge.** Remsberg, L.P. (Brookhaven National Lab., Upton, NY (USA)); Hampel, W. 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

The series of ^{71}Ge halflife measurements has been completed. The final result is 11.43 +- 0.03 days.

8909 (INIS-mf—8307, pp 21-27) **Decay studies of very neutron-rich isotopes produced in multinucleon transfer reactions.** Tidemand-Petersson, P.; Runte, E.; Schmidt-Ott, W.D.; Gippert, K.L. (Goettingen Univ. (Germany, F.R.). 2. Physikalisches Inst.); Kirchner, R.; Klepper, O.; Kurcewicz, W.; Roeckl, E.; Schardt, D. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)); Kaffrell, N. 1983. NTIS (US Sales Only), PC A11/MF A01. (CONF-830118—).

From 11. international workshop on gross properties of nuclei and nuclear excitations; Hirschegg, Austria (17 Jan 1983).

In the following we summarize the results from β-γ decay studies, which we performed by means of β-, γ- and X-ray spectroscopy of the mass-separated activity.

8910 (INIS-mf—8307, pp 28-30) **Exotic nuclei reached by transfer reactions induced with a ^{14}C beam.** Bernas, M.; Dessagne, P.; Langevin, M.; Payet, J.; Pougheon, F.; Roussel, P. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). 1983. NTIS (US Sales Only), PC A11/MF A01. (CONF-830118—).

From 11. international workshop on gross properties of nuclei and nuclear excitations; Hirschegg, Austria (17 Jan 1983).

We report on a study of the (^{14}C, ^{16}O) and (^{14}C, ^{15}O) reactions on isotopically separated ^{70}An and ^{64}Ni targets.

8911 (INIS-mf—8636) **Scattering of polarized protons by nickel, strontium, cadmium, indium and tin isotopes.** Wassenaar, S.D. (Technische Hogeschool Eindhoven (Netherlands)). 12 Nov 1982. 122p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE83704740.

Proton scattering experiments are described using polarized protons of 20.4 or 24.6 MeV and target nuclides with (nearly) one closed shell: ^{60}Ni, ^{64}Ni, ^{86}Sr, ^{88}Sr, ^{110}Cd, ^{112}Cd, ^{114}Cd, ^{115}In, ^{116}Sn, ^{118}Sn, ^{120}Sn, ^{122}Sn, ^{124}Sn. The experimental arrangement is outlined and the results are presented. The data are analysed using the direct scattering theory and two currently available, nuclear models - the collective (macroscopic) and the shell (microscopic) models.

8912 (INIS-mf—8659) **Nuclear structure of ^{88}Sr and ^{90}Zr investigated by (e,e') and (p,p') reactions.** Bijl, L.T. van der. (Vrije Univ., Amsterdam (Netherlands)). 11 Nov 1982. 139p. NTIS (US Sales Only), PC A07/MF A01. Order Number DE83704743.

In this thesis the results are presented and discussed from two experiments, performed to investigate the nuclear structure of two N = 50 nuclei: a high resolution inelastic proton scattering experiment on ^{90}Zr, described in chapter II, and a high resolution inelastic electron scattering experiment on ^{88}Sr, described in chapters III and IV. The results obtained in the $^{88}Sr(e,e')$ experiment for the 1^+ state at 3.486 MeV excitation energy are described separately in chapter V. The $^{90}Zr(p,p')$ experiment was performed at a bombarding energy of 25 MeV with a resolution of 12 to 16 keV. The $^{88}Sr(e,e')$ measurements were performed at two laboratories with an overall resolution between 20 and 60 keV.

8913 (ISN—82-07) **Level structure of ^{60}Ni from the $^{58}Ni(\alpha,2p\gamma)$ reaction.** Chan, T.U.; Morand, C.; Azgui, F. (Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires). Mar 1982. 40p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83704083.

The ^{60}Ni nucleus has been studied via the ^{58}Ni (α, 2pγ) reaction at Esub(α)=32 MeV using in-beam γ spectroscopy techniques. High-spin states up to 10 MeV excitation have been established. Among the 5 branches depopulating the Yrast Jsup(π)=7^- state, has been found an E3 transition down to the 4^+ state. Comparison with direct reaction results leads to assign very probably the [νfsub(5/2),νgsub(9/2)]$_7$- configuration to the Jsup(π)=7^- Yrast state at 5349 keV. Other high-spin states might be accounted for by the breaking of the ^{56}Ni core.

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8914 (DOE/ER/10626—T1) **Relativistic heavy ion physics research with triggered streamer chamber. Annual report, 1983.** Fung, S.Y.; Poe, R.T. (California Univ., Riverside (USA)). Oct 1983. Contract AT03-80ER10626. 20p. NTIS, PC A02/MF A01. Order Number DE84004955.

In the year 1983, the relativistic heavy ion physics (RHI) research program at U.C. Riverside has been vigorously pursed along three broad directions: the study of RHI central collisions from our on-going triggered streamer chamber experiments; explorations and technical developments to enhance our present and future research capabilities; and a new research initiative in the adaptation and extension of LBL's HISS facility for high statistics study of multiparticle correlations in central collisions. Activities are described.

8915 (EGG-M—14183) **Delayed neutron energy spectra of $^{93-97}Rb$.** Greenwood, R.C.; Caffrey, A.J. (EG and G Idaho, Inc., Idaho Falls (USA)). 1983. Contract AC07-76ID01570. 7p. (CONF-831047—107). NTIS, PC A02/MF A01. Order Number DE84003025.

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

Sets of high-statistical-quality delayed-neutron energy spectra were obtained from the precursor nuclides $^{93-97}Rb$ covering an energy range from ~ 10 keV to ~ 1300 keV. The data for each of the Rb isotopes show good qualitative agreement with the ^3He ionization chamber data at energies ≧ 200 keV. In addition, they provide definitive spectral information down to ~ 10 keV. Fine structure in this lower energy region with energy resolution much better than that obtained using ^3He ionization chambers was observed, i.e., the FWHM varies from ~ 2 keV at 10 keV to ~ 12 keV at 200 keV. A notable feature the data is that they confirm the existence of strong 14.1 and 26.4 keV lines in the ^{95}Rb spectrum. Furthermore, the value of 10.4% we obtain for the relative intensity of

the 14.1-keV line is significantly greater than the values of 5.9%[3] and 4%[4] inferred from ^{3}He spectrometry.

8916 (INIS-mf—8156, pp 202-208) **Search for ^{150}Nd and ^{130}Te 2β-decay at Baksan observatory.** Baskov, M.P.; Klimenko, A.A.; Koval'chuk, E.L.; Pomansky, A.A.; Smol'nikov, A.A.; Temmoev, A.H. (AN SSSR, Moscow. Inst. Yadernykh Issledovanij). 1982. NTIS (US Sales Only), PC A19/MF A01. (CONF-820675—Vol.1).

From International conference on neutrino physics; Balaton, Hungary (14 Jun 1982).

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Previous works concerning neutrinoless 2β-decay do not exclude the possibility that such a process can proceed through a right handed current, Δ-resonance, CHI sup(ν)-majoron or scalar particle. The probability of the 2β(0ν)-decay by these modes, in some cases, can be comparable with the process for msub(ν) not=0; lambda=0. The installations for the multidimensional analysis of 2β-decay are described and the preliminary results obtained are presented.

8917 (INIS-mf—8156, pp 209-215) **Study of double beta decay of ^{100}Mo.** Zdesenko, Yu. G.; Kuts, V.N.; Mitsik, I.A.; Nikolaiko, A.S. (AN Ukrainskoj SSR, Kiev. Inst. Yadernykh Issledovanij). 1982. NTIS (US Sales Only), PC A19/MF A01. (CONF-820675—Vol.1).

From International conference on neutrino physics; Balaton, Hungary (14 Jun 1982).

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The experiment was carried out for the research of neutrinoless double beta decay of ^{100}Mo with energy release of 3032.6 keV. A sample of molybdenum was used, enriched by the isotope ^{100}Mo to 99.5%. The total mass of ^{100}Mo was equal to 390 g. A half-life lower limit of $>2.1\times10^{21}$ y for the neutrinoless 2β-decay at the 68% confidence level mass was established.

8918 (INIS-mf—8156, pp 216-230) **Some new experimental results on double beta decay.** Bellotti, E. (Istituto Nazionale di Fisica Nucleare, Milan (Italy)). 1982. NTIS (US Sales Only), PC A19/MF A01. (CONF-820675—Vol.1).

From International conference on neutrino physics; Balaton, Hungary (14 Jun 1982).

Portions are illegible in microfiche products7 refs.

The results of two new experiments on double beta decay are reported. In the first one, by T. Kirsten (Heidelberg), the half-life of tellurium 128 and 130 have been measured; results are in agreement with theoretical predictions for 2ν's emission and don't require any contribution from neutrinoless decay, in strong disagreement with previous results. In the second experiment, by ives-new limits on the half-l for transitions on ground and excited levels of germanium and other nuclides have been obtained.

8919 (INIS-mf—8299, pp 120-121) **Can double beta decay solve the problem of the neutrino rest mass.** Grotz, K.; Klapdor, H.V.; Metzinger, J. 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphyik: Annual report 1982.

The 2ν double beta ($\beta\beta$) decay of ^{130}Te and ^{128}Te is calculated in the BCS pairing model. A correct treatment of the phase space integral shows that the Pontecorvo argument leads to an incorrect half-life ratio. This has severe impact on the discussion of neutrinoless $\beta\beta$ decay and a possible neutrino mass.

8920 (INIS-mf—8299, pp 80) **Study of α emission from dinuclear systems in coincidence with the 'fast fission' channel.** Fan, G.Y. (Academia Sinica, Lanchow (China). Inst. of Modern Physics); Wolski, R. (Institute of Nuclear Physics, Krakow (Poland)); Bruckner, A.; Ho, H.; Lindl, B.; Muffler, R.; Pfoh, A.; Schad, L.; Wurm, J.P. 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

We have measured α emission in coincidence with the "fast-fission" channel in 350 MeV ^{35}Cl + Ag reactions in order to study α emission from the dinuclear system. However, sequential emission from fission fragments obscures simple interpretation of measured α energies and angular correlations. Refined calculations and completing experiments are in progress in order to isolate α emission prior to scission and to draw shape information therefrom.

8921 (INIS-mf—8299, pp 80-84) **Investigation of sequential fission of heavy nuclei.** Glaessel, P.; Harrach, D. v.; Schukraft, J.; Specht, H.J. 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

Sequential fission was investigated in the reaction ^{238}U + ^{248}Cm at 8.43 MeV/u. From the absence of Coulomb final state interactions a time limit of 1-1.5 x 10^{-20} s is deduced for the lifetime of intermediate fissioning systems with Z up to 120. The angular distributions of sequential fission in the reaction of ^{208}Pb + ^{90}Zr were studied vs. energy loss. In-plane anisotropies of proportional 1:2 are found at moderate energy losses which decrease and even change sign towards larger energy losses. In the system U + U at 7.5 MeV, sequential fission events associated with low excitations were investigated. The fission probability, measured down to 10^{-3} for scattering angles forward of grazing, behaves as expected for compound fission induced by Coulomb excitation.

8922 (INIS-mf—8299, pp 90-91) **Study of the γ-decay of the 1(h/2π)ω octupole resonance in ^{90}Zr.** Clausing, R.; Grabmayr, P.; Kihm, T.; Klein, R.; Knoepfle, K.T.; Schmidt, H.R.; Seegert, G.; Wagner, G.J. 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

The 1(h/2π)ω low-energy octupole resonance (LEOR) in ^{90}Zr is selectively excited by inelastic scattering of 49 MeV α particles from the Heidelberg boosted MP Tandem. The γ-ray multiplicities extracted from a ^{90}Zr(α, α'γ) coincidence experiment exhibit a strong fluctuation throughout the LEOR region which suggests the existence of nonstatistical decays of individual LEOR components.

8923 (INIS-mf—8299, pp 97-100) **Giant dipole transitions in the γ decay following heavy ion reactions.** Habs, D.; Helmolt, U. v.; Heyng, H.W.; Kroth, R.; Pelte, D.; Schwalm, D. (Heidelberg Univ. (Germany, F.R.). Physikalisches Inst.); Kolb, B.; Simon, R.S.; Albrecht, R. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)); Metag, V. (Giessen Univ. (Germany, F.R.). 2. Physikalisches Inst.). 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

The giant resonance component in the γ decay following the ^{128}Te + ^{34}S compound nucleus reaction is studied by exploiting the experimental possibilities provided by the NaI crystal ball spectrometer. After suppression of background radiation of suitable gating conditions, the proper (HI, xn) component of the γ radiation is studied as a function of the magnitude of the nuclear spin at the start of the γ cascade. The strength function extracted for the giant resonance intensity is centered around 10 MeV at low spins of about 10 (h/2π) and gradually shifts to about 11.5 MeV for the highest spins of 55 (h/2π). The anisotropy of the giant resonance component measured relative to the spin direction is discussed.

8924 (INIS-mf—8299, pp 117-118) **Study of the yrast cascade of ^{158}Er with the crystal ball spectrometer.** Albrecht, R.; Kolb, B.; Simon, R.S. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)); Habs, D.; Helmer, K.; Helmolt, U. v.; Heyng, H.W.; Krieger, H.; Pelte, D.; Schwalm, D. (Heidelberg Univ. (Germany, F.R.). Physikalisches Inst.). 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphyik: Annual report 1982.

The yrast line of ^{158}Er has been studied with the crystal ball supplemented by three Ge detectors. A possible 40^+ level is observed in a smooth continuation of the known level sequence up to 38^+.

8925 (INIS-mf—8299, pp 169-170) **Improved limit of the neutrino rest mass from new double beta decay experiments.** Kirsten, T.; Richter, H.; Jessberger, E.K. 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

The violation of leptonic charge conservation in Neutrinoless Double Beta Decay is made possible either by a right handed current admixture (amplitude eta) to the leptonic current or by a non-vanishing neutrino restmass. Particularly stringent limits on

msub(ν) and eta result from the ratio of Double Beta Decay rates of ^{128}Te and ^{130}Te. From our determination of this ratio applying the geochemical method to a Precambrian Tellurium ore we obtain a limit of msub(ν) <= 5.6 eV (2sigma).

8926 (INIS-mf—8307, pp 42-44) **Seniority isomerism in (πhsub(11/2))sup(n) excitations; favoured β transitions πhsub(11/2) -> νhsub(9/2).** Nolte, E. (Technische Univ. Muenchen, Garching (Germany, F.R.). Fakultaet Physik). 1983. NTIS (US Sales Only), PC A11/MF A01. (CONF-830118—).

From 11. international workshop on gross properties of nuclei and nuclear excitations; Hirschegg, Austria (17 Jan 1983).

The proton rich N=82 isotones were studied with ^{58}Ni induced compound reactions on ^{93}Nb, ^{94}Mo and ^{96}Ru targets.

8927 (INIS-mf—8307, pp 60-64) **Studies of very neutron-deficient nuclei at and beyond the proton-drip-line.** Kirchner, R.; Klepper, O.; Kurcewicz, W.; Larsson, P.O.; Roeckl, E.; Schardt, D. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)); Nyman, G. (Chalmers Tekniska Hoegskola, Goeteborg (Sweden)); Tidemand-Petersson, P. (Goettingen Univ. (Germany, F.R.)). 1983. NTIS (US Sales Only), PC A11/MF A01. (CONF-830118—).

From 11. international workshop on gross properties of nuclei and nuclear excitations; Hirschegg, Austria (17 Jan 1983).

We present new results on the proton decay of ^{147}Tm which was explored at the GSI on-line separator. In parallel to these studies the β-delayed proton decays of ^{147}Er and ^{147}Dy were investigated.

8928 (INIS-mf—8307, pp 112-115) **First experiments at SARA at 30 MeV/N.** Martin, P. (Institut des Sciences Nucleaires, 38 - Grenoble (France)). 1983. NTIS (US Sales Only), PC A11/MF A01. (CONF-830118—).

From 11. international workshop on gross properties of nuclei and nuclear excitations; Hirschegg, Austria (17 Jan 1983).

Beams of thirty MeV per nucleon heavy ions up to ^{20}Ne have now been readily available for four months at SARA (ISN Grenoble). Various types of experiments have been performed and preliminary results have come out, analyses being in progress. This report only aims at giving an overview of these first experiments, showing the differences with lower incident energies.

8929 (INIS-mf—8307, pp 153-158) **Experimental study of α-α correlations in the reaction sup(nat)Ag + ^{40}Ar (285 MeV).** Pomorski, L.; Artukh, A.G.; Gridnev, G.F.; Gruszecki, M.; Karcz, W.; Mezentsev, A.N.; Mikheev, V.L.; Volkov, V.V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1983. NTIS (US Sales Only), PC A11/MF A01. (CONF-830118—).

From 11. international workshop on gross properties of nuclei and nuclear excitations; Hirschegg, Austria (17 Jan 1983).

The angular and energy correlations have been measured for α particles emitted in one plane including the beam axis, and in two perpendicular planes. The main results of these experiments are given in the present contribution.

8930 (INIS-mf—8307, pp 79-82) **Gamma-ray circular polarization in Kr-induced reactions at 10 MeV/A.** Schandera, C.; Lauterbach, C.; Boer, J. de; Duennweber, W.; Trautmann, W. (Muenchen Univ. (Germany, F.R.). Sektion Physik). 1983. NTIS (US Sales Only), PC A11/MF A01. (CONF-830118—).

From 11. international workshop on gross properties of nuclei and nuclear excitations; Hirschegg, Austria (17 Jan 1983).

We have measured the circular polarization of the coincident γ-radiation which carries information on the relative contributions of positive and negative angle scattering. Since the deflection function may depend on the dynamical parameters of the exit channel, the polarization was measured as a function of the exit-channel energy, the mass asymmetry, and the scattering angle.

8931 (IPNO-T—83-02) **Experimental study of fusion nuclei formation and deexcitation for mass around 150μ formed by bombardment of heavy ions at 3 to 5 MeV/nucleon energy. Emission of a few neutrons (1, 2 or 3).** Cabot, C. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire; Paris-11 Univ., 91 - Orsay (France)). 1983. 186p. (In French). NTIS (US Sales Only), PC A09/MF A01. Order Number DE84750229.

Portions are illegible in microfiche products.

It has been experimentally pointed out that a nucleus formed, in the rare earth region, at high angular momentum (approximately 40 h) and high excitation energy (approximately 55 MeV), through a rather symetric system (like ^{65}Cu + ^{87}Rb → ^{152}Dy), can deexcite by emitting only 1 or 2 neutrons. To explore the statistical or non-statistical character of a few neutrons emission, γ-n competition has been studied. All the measurements (total γ energy, γ-multiplicity associated with each exit channel, and neutron energy spectra) point out the statistical character, which is related to the unexpectedly strong γ-competition at high J :the γ entry-line constructed in the (E * J) plane for several identified exit channels, diverges from the Yrast line at the highest J. Comparison between various experimental results (including excitation functions (HI, xn) sup(150-x)Gd) and statistical calculations (GROGI-F code) has been used as a crucial test for the choice of the Yrast-line position and of the γ-normalization coefficients. Some experimental results concerning sub-barrier fusion and fission cross-sections are also presented in this thesis.

8932 (ISN—82-39) **Esub(γ)-Esub(γ) correlation studies in the cerium isotopes.** Gizon, A.; Lindblad, T.; Johnson, A.; Hildingsson, L.; Klamra, W.; Jerrestam, D.; Hjorth, S.A.; Bialkowski, J.; Vertse, T. (Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires). Aug 1982. 3p. (CONF-820896—8-Summ.). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704087.

From Nordic meeting on nuclear physics; Fuglso, Denmark (16 Aug 1982).

8933 (ITEF—47(1982)) **Possibility of measurement of double neutrinoless β decay of ^{136}Xe.** Boris, S.D.; Golutvin, A.I.; Danilov, M.V.; Zel'dovich, O.Ya.; Kamyshkov, Yu.A.; Kirichenko, V.V.; Kozodaeva, O.M.; Lyubimov, V.A.; Tikhomirov, I.N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1982. 27p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83704089.

A possibility of measurement of double neutrinoless β decay in a proportional-drift chamber is considered. ^{136}Xe with a sensitivity level of 10^{23} years for a half-life period is chosen as a chamber working substance.

8934 (ITEP—67(1982)) **Inclusive proton and neutron production at 120 deg by 7.5 GeV/c protons on nuclei.** Bayukov, Yu.D.; Degtyarenko, P.V.; Druzhinin, B.L. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1982. 12p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704090.

Measurements of nucleon production at 120 deg have been carried out in 7.5 GeV/c proton-nucleus interactions. The ratios Rsub(n/p) of secondary neutrons to protons are considered in detail. Rsub(n/p) depends on kinetic energy of secondary nucleons and this dependence is more pronounced for heavy nuclei. The dependence of this ratio on the incident particle charge and the asymmetry corresponded to dirrerent number of protons and neutrons in the nucleus are discussed.

6518 Nuclear Properties And Reactions, A=150-189, Theoretical

8935 **(ANU-P—843) Measurement of pre-fission neutrons from ^{200}Pb; further limits to the statistical fission parameters.** Ward, D.; Charity, R.J.; Hinde, D.J.; Leigh, J.R.; Newton, J.O. (Australian National Univ., Canberra. Dept. of Nuclear Physics). Mar 1983. 29p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83704075.

The average number of pre-fission neutrons ν sub(pre) emitted following fusion of ^{181}Ta and ^{19}F has been measured. The multiplicity is 2.1 +- 0.5, 2.7 +- 0.5 and 2.9 +- 0.5 at bombarding energies of 105, 115 and 125 MeV respectively. Thus, on average, fission occurs about half way down the neutron evaporation chain for ^{200}Pb. Calculated values of ν sub(pre), from the statistical/rotating liquid drop model, are extremely sensitive to a sub(f) / a sub(n), the ratio of the level density parameters at the saddle point and equilibrium deformations. The results restrict the effective value of a sub(f) / a sub(n) to 1.02 +-0.02.

8936 **(CONF-821143—13) Lifetimes of high-spin states of ^{160,161}Yb.** Fewell, M.P.; Baktash, C.; Guidry, M.W.; Hattula, J.S.; Johnson, N.R.; Lee, I.Y.; McGowan, F.K.; Ower, H.; Pancholi, S.C.; Riedinger, L.L. (Tennessee Univ., Knoxville (USA); Jyvaeskylae Univ. (Finland); Delhi Univ. (India); Vanderbilt Univ., Nashville, TN (USA); Tennessee Technological Univ., Cookeville (USA)). 1982. Contract W-7405-ENG-26. 9p. NTIS, PC A02/MF A01. Order Number DE84003277.

From High angular momentum properties of nuclei conference; Oak Ridge, TN, USA (2 Nov 1982).

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Recoil-distance measurements of lifetimes of high-spin states of ^{160,161}Yb are described. While the results for the ground band of ^{160}Yb are not inconsistent with centrifugal stretching, the addition of one or more quasineutrons seems to cause a reduction in collectivity which depends on frequency but not, for the case examined, on the type of quasineutron. 9 references.

8937 **(DOE/ER/01672—78) Studies of yrast and continuum states in A = 140 to 160 nuclei. Progress report for 1983.** Daly, P.J. (Purdue Univ., Lafayette, IN (USA)). Dec 1983. Contract AC02-76ER01672. 13p. (COO—1672-78). NTIS, PC A02/MF A01. Order Number DE84004616.

The structure of nuclei, principally in the A-150 region, has been studied by in-beam γ-ray spectroscopy using heavy ion beams from the Argonne Tandem/Linac. New structural information was obtained for many shell model nuclei around ^{146}Gd, for the shape transitional nuclei ^{153}Dy and ^{154}Dy, and for the nuclei ^{147}Gd, ^{186}Hg, and ^{187}Hg at high-spin.

8938 (INIS-mf—8299, pp 85-86) **Angular distributions of fission following fusion of ^{35}Cl with ^{178}Hf, ^{197}Au and ^{238}U.** Payer, P.; Civelekoglu, Y.; Glaessel, P.; Harrach, D. v.; Helm, P.; Kapoor, S.S.; Specht, H.J.; Wallenwein, K. 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

Fission angular distributions were determined for nuclei formed by the fusion of ^{35}Cl with ^{178}Hf, ^{197}Au and ^{238}U at 226 MeV and 255 MeV. The distributions are more anisotropic than predicted.

8939 (INIS-mf—8299, pp 114-115) **Magnetic moments in the backbending region of ^{158}Dy.** Seiler-Clark, G.; Pelte, D.; Schwalm, D. (Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.)); Emling, H.; Grein, H.; Grosse, E.; Wollersheim, H.J. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)); Balanda, A.; Kulessa, R. (Uniwersytet Jagiellonski, Krakow (Poland)); Hass, M. (Weizmann Inst. of Science, Rehovoth (Israel)). 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphyik: Annual report 1982.

Yrast levels in the backbending region of ^{158}Dy were Coulomb excited with a 4.7 MeV/u ^{208}Pb beam. Employing the transient field technique with a thin magnetized iron foil, the precessions of angular correlations of decay γ-rays from levels up to spin Isup(π) = 16^+ were measured. The results show a clear reduction of the g-factor for states in the backbending region relative to that of the low-spin levels, thus demonstrating that the backbending of ^{158}Dy is mainly caused by the alignment of isub(13/2) neutrons. In a similar experiment, precession measurements on Coulomb excited lowspin levels of ^{164}Dy served to determine the static hyperfine field of Dy in Fe and the g-factor of the 6^+ state in ^{164}Dy.

8940 (INIS-mf—8307, pp 45-59) **Proton radioactivity of ^{151}Lu and neighbouring nuclei.** Hofmann, S.; Armbruster, P.; Hessberger, F.P.; Muenzenberg, G.; Reisdorf, W.; Schneider, J.R.H.; Schoett, H.J. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). 1983. NTIS (US Sales Only), PC A11/MF A01. (CONF-830118—).

From 11. international workshop on gross properties of nuclei and nuclear excitations; Hirschegg, Austria (17 Jan 1983).

For N = 80 isotones level schemes have been extrapolated up to ^{151}Lu, a nucleus one proton above the middle of the 1hsub(11/2) subshell. Proton decay probabilities of ^{151}Lu and neighbouring nuclei are discussed in the frame of these level schemes.

8941 (INIS-mf—8307, pp 83-86) **Nuclear proton emission predictions.** Feix, W.F.; Hilf, E.R. (Technische Hochschule Darmstadt (Germany, F.R.). Inst. fuer Kernphysik). 1983. NTIS (US Sales Only), PC A11/MF A01. (CONF-830118—).

From 11. international workshop on gross properties of nuclei and nuclear excitations; Hirschegg, Austria (17 Jan 1983).

Also published in Phys. Lett., B (6 Jan 1983) v. 120(1-3) p. 14-18.

The authors have quantum mechanically calculated the proton emission decay widths in close analogy to the alpha decay by solving the quasistationary Schroedinger equation with a complex energy. They present the half-lives for the nuclei ^{183}Bi, ^{175}Tl, ^{171}Au, ^{165}Ir, ^{161}Re, and ^{155}Ta.

8942 (INIS-mf—8307, pp 87-90) **Forward emission of neutrons.** Brosa, U. (Marburg Univ. (Germany, F.R.). Fachbereich Physik). 1983. NTIS (US Sales Only), PC A11/MF A01. (CONF-830118—).

From 11. international workshop on gross properties of nuclei and nuclear excitations; Hirschegg, Austria (17 Jan 1983).

The author has calculated the angular distribution of the neutrons emitting in forward direction in heavy ion fusion reactions by integration of the time-dependent Schroedinger equation.

8943 (INIS-mf—8307, pp 107-111) **Dissipative diabetic dynamics (DDD): A theory for heavy-ion collisions between TDHF and transport theories.** Cassing, W.; Lukasiak, A.; Noerenberg, W. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). 1983. NTIS (US Sales Only), PC A11/MF A01. (CONF-830118—).

From 11. international workshop on gross properties of nuclei and nuclear excitations; Hirschegg, Austria (17 Jan 1983).

We performed TDHF calculations for head on collisions of ^{86}Kr on ^{166}Er at three bombarding energies of 8.2, 15 and 20 MeV/u.

8944 (INIS-mf—8307, pp 36-41) **Laser spectroscopy on unstable rare-earth nuclides in the transitional region N > 82.** Neugart, R.; Klempt, W. (European Organization for Nuclear Research, Geneva (Switzerland). ISOLDE Collaboration); Buchinger, F.; Mueller, A.C.; Wendt, K. (Mainz Univ. (Germany, F.R.). Inst. fuer Physik); Ekstroem, C. (Chalmers Tekniska Hoegskola, Goeteborg (Sweden)). 1983. NTIS (US Sales Only), PC A11/MF A01. (CONF-830118—).

From 11. international workshop on gross properties of nuclei and nuclear excitations; Hirschegg, Austria (17 Jan 1983).

The present work on neutron-deficient heavier rare-earth isotopes has been stimulated by the observation of a smooth increase of deformation for the Ba isotopes above the neutron-shell closure N=82, up to N=90. This experiment was performed by

using the technique of collinear fast-beam laser spectroscopy, adapted to the 60 keV beam from ISOLDE.

8945 (INIS-mf—8307, pp 159-163) **Angular momentum of the residual nucleus after the emission of very fast alpha particles in heavy ion reactions.** Kamanin, V.V.; Kugler, A.; Oganessian, Yu.T.; Penionzhkevich, Yu.E.; Ruediger, J. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1983. NTIS (US Sales Only), PC A11/MF A01. (CONF-830118—).

From 11. international workshop on gross properties of nuclei and nuclear excitations; Hirschegg, Austria (17 Jan 1983).

We measured the γ-ray multiplicity after the emission of an alpha particle in the reaction ^{181}Ta + ^{22}Ne /150MeV,155MeV and 160MeV/.

8946 (INIS-mf—8307, pp 71-78) **Signature of rigid rotation in ^{20}Ne + ^{168}Er collisions at 13.5 MeV/A.** Duenn-weber, W.; Hering, W.; Puchta, H.; Ritzka, R.; Trautmann, W.; Trombik, W. (Muenchen Univ. (Germany, F.R.). Sektion Physik); Egelhaaf, C.; Homeyer, H. (Hahn-Meitner-Institut fuer Kernforschung Berlin G.m.b.H. (Germany, F.R.)). 1983. NTIS (US Sales Only), PC A11/MF A01. (CONF-830118—).

From 11. international workshop on gross properties of nuclei and nuclear excitations; Hirschegg, Austria (17 Jan 1983).

In coincidence with light fragments, detected with ΔE-E telescopes, we have measured (i) the intensities and the anisotropies of discrete yrast γ-decays, using large high-resolution Ge(Li) detectors, (ii) the circular polarization of the energy-integrated γ radiation, using Compton forward-scattering polarimeters, and (iii) the multiplicity of γ-rays, using 5" x 6" NaI crystals.

8947 **Precision muonic-atom measurements of nuclear quadrupole moments and the Sternheimer effect in rare-earth atoms.** Tanaka, Y.; Steffen, R.M.; Shera, E.B.; Reuter, W.; Hoehn, M.V.; Zumbro, J.D. (Department of Physics, Purdue University, West Lafayette, Indiana 47907). *Physical Review Letters;* **51**: No. 18, 1633-1635(31 Oct 1983).

The ground-state quadrupole moments of ^{151}Eu, ^{153}Eu, ^{155}Gd, ^{157}Gd, ^{159}Tb, ^{163}Dy, ^{167}Er, ^{177}Hf, ^{179}Hf, ^{191}Ir, and ^{193}Ir were determined with an uncertainty of less than one percent by measuring the quadrupole hyperfine-splitting energies of muonic M x rays. The results are used to determine experimentally Sternheimer shielding factors for the 4f, 5d, and 6p electronic states of the respective atoms. The deduced shielding factors for the 5d electronic states were found to vary considerably among these elements, presumably as a result of configuration mixing.

6519 Nuclear Properties And Reactions, A=190-219, Theoretical

8948 (INIS-mf—8299, pp 151) **Dynamical effects in finite nuclei.** Ratcliff, K.F. (State Univ. of New York, Albany (USA)); Kuo, T.T.S. (State Univ. of New York, Stony Brook (USA)); Sommermann, H.M. 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

8949 (INIS-mf—8299, pp 101-102) **Spectroscopy of proton-particle-hole states in ^{209}Pb.** Grabmayr, P.; Mairle, G.; Schmidt-Rohr, U.; Wagner, G.J. (Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.)); Berg, G.P.A.; Martin, S.; Meissburger, J.; Roemer, J.; Huerliman, W.; Tain, J. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.)). 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphyik: Annual report 1982.

A high resolution measurement of the (d, ^{3}He) reaction on ^{208}Pb and ^{209}Bi yields detailed information on the properties of proton hole states of ^{207}Tl (jsub(h) = 3ssub(1/2), 2dsub(3/2), 1hsub(11/2), 2dsub(3/2)) and of the respective proton-particle-hole states of ^{209}Pb (jsub(p) = 1hsub(9/2)).

8950 (INIS-mf—8299, pp 102-105) **Determination of the electric quadrupole moment of ^{7}Li.** Blatt, K.; Fick, D.; Koenig, I. (Marburg Univ. (Germany, F.R.). Fachbereich Physik); Caplar, R. (Institut Rudjer Boskovic, Zagreb (Yugoslavia)); Egelhof, P. (Basel Univ. (Switzerland). Inst. fuer Physik); Karban, O. (Birmingham Univ. (UK)); Moroz, Z.; Rusek, K. (Institute of Nuclear Research, Warsaw (Poland)); Kraemer, D.; Moebius, K.H. 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphyik: Annual report 1982.

An experiment to determine the ground state quadrupole moment of ^{7}Li by Coulomb scattering of aligned nuclei has been performed. The observable, the tensor analysing power T_{20}, is in first order proportional to the spectroscopic quadrupole moment of the projectile. An optimized experimental setup allowed a systematic investigation of T_{20} at different energies and using different targets. First data are presented and discussed in the framework of a semiclassical analysis. A quantum mechanical treatment of Coulomb scattering by the coupled channel method (Code ECIS, J, Raynal) is in progress.

8951 (INIS-mf—8299, pp 115-117) **Spectroscopy of sup(220,222)Th.** Bonin, W.; Dahlinger, M.; Glienke, S.; Kankeleit, E.; Kraemer, M. (Technische Hochschule Darmstadt (Germany, F.R.). Inst. fuer Kernphysik); Backe, H. (Mainz Univ. (Germany, F.R.). Inst. fuer Physik); Habs, D.; Schwartz, B. (Heidelberg Univ. (Germany, F.R.). Physikalisches Inst.); Goerlach, U. 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphyik: Annual report 1982.

The level schemes of sup(220,222)Th have been investigated by conversion electron and γ-ray spectroscopy methods using the reactions ^{208}Pb (sup(16,18)O,4n). To reduce the strong fission background a small electrostatic separator was coupled to the solenoid spectrometer. It detects the evaporation residues separated from projectiles and fission fragments and thus serves as a fast trigger selecting e^- and γ transitions. The level scheme of ^{222}Th constructed using γ-γ-ER, e^--γ-ER and e^--e^--ER coincidences may be explained by the molecular cluster model.

8952 (INIS-mf—8307, pp 1-15) **New elements.** Muenzenberg, G.; Agarwal, Y.K.; Hessberger, F.P.; Hofmann, S.; Poppensieker, K.; Reisdorf, W.; Schneider, J.H.R.; Schneider, W.F.W.; Schmidt, K.H.; Schoett, H.J. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). 1983. NTIS (US Sales Only), PC A11/MF A01. (CONF-830118—).

From 11. international workshop on gross properties of nuclei and nuclear excitations; Hirschegg, Austria (17 Jan 1983).

In the last years we have developed a technique, which permits the identification of single nuclei with lifetimes down to 10^{-6} s and production cross sections far below the nanobarn region. At SHIP we investigated the elements Fm, Md, 104, 105, 107, and 109 by fusion of Pb or Bi nuclei with ^{40}Ar, ^{50}Ti, ^{54}Cr, or ^{58}Fe projectiles, respectively. The projectile energies were chosen close to the Coulomb-barrier. With these target-projectile combinations, cold compound systems with excitation energies of 20 MeV and less could be formed. So even for the heaviest and most fragile nuclei a small but reasonable chance exists to survive the strong fission competition in the deexcitation of the compound system.

8953 **Search for fractional charges produced in heavy-ion collisions at 1.9 GeV/nucleon.** Lindgren, M.A.; Joyce, D.C.; Abrams, P.C.; Bland, R.W.; Johnson, R.T.; Knoop, T.D.; Savage, M.H.; Scholz, M.H.; Young, B.A.; Hodges, C.L. (Physics and Astronomy Department, San Francisco State University, San Franciso, California 94132). *Physical Review Letters;* **51**: No. 18, 1621-1624(31 Oct 1983).

An experiment was performed to capture fractionally charged particles produced in heavy-ion collisions and to concentrate them in samples suitable for analysis by various techniques. Two of the samples so produced have been searched, with use of an automated version of Millikan's oil drop apparatus. The beam was ^{56}Fe at 1.9 GeV/nucleon, incident on a lead target. Less than one fractional charge per 1.0 x 10^4 Fe-Pb collisions was found to be

produced, and, with further assumptions, less than one per 2.0 x 10^6 collisions.

8954 **Isospin dependence of the microscopic optical model for nucleon scattering.** Dietrich, F.S.; Finlay, R.W.; Mellema, S.; Randers-Pehrson, G.; Petrovich, F. (University of California, Lawrence Livermore National Laboratory, Livermore, California 94550). *Physical Review Letters;* **51**: No. 18, 1629-1632(31 Oct 1983). Contract W-7405-ENG-48.

New experimental data for the elastic scattering of 7—24-MeV neutrons from ^{208}Pb are presented, and a microscopic folding-model study of neutron and proton elastic scattering data for ^{208}Pb at energies below 60 MeV is made to examine the isospin dependence of an effective interaction derived from nuclear-matter calculations. The theoretically derived interaction yields reasonable agreement with the data if the Coulomb potential is treated properly.

6520 Nuclear Properties And Reactions, A=220 And Above, Theoretical

8955 **(CEA-CONF—6619) Investigation of fast fission in the ^{35}Cl + ^{238}U system.** Leray, S.; Chen, X.S.; Fan, G.Y. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Jan 1983. 17p. (CONF-830117—10). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704077.

From 21. international winter meeting on nuclear physics; Bormio, Italy (24 Jan 1983).

We have investigated the ^{35}Cl + ^{238}U system between 240 and 350 MeV at the MP-tandem post accelerator combination in Heidelberg. The fission-like fragments of the total system were detected, their energy and mass were measured. From this it was possible to deduce the fusion cross section which was compared with several theoretical models. The interpretation of the symmetric fragmentation mass distribution in terms of fast fission is discussed.

8956 **(CEA-CONF—6620) Existence of pear-shaped nuclei.** Blons, J.; Fabbro, B.; Hisleur, J.M.; Julien, J.; Mazur, C.; Patin, Y.; Paya, D.; Ribrag, M. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Jan 1983. 9p. (CONF-830117—11). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704078.

From 21. international winter meeting on nuclear physics; Bormio, Italy (24 Jan 1983).

In this paper we present results for the ^{230}Th (d,pf) reaction, around 5.9 MeV excitation energy, obtained with an appropriate proton-fission time coincidence and an overall energy resolution of FWHM approximately 6keV. The resulting data shows the very same fine structure previously observed for the lower l values in the corresponding ^{230}Th (n,f) reaction, but an additional set of higher spin states, not accessible with (n,f) reaction also appears. These new results support and confirm our previous interpretation of the (n,f) data, namely that we are again observing two close-lying rotational bands with opposite parities but this for l values up till 5 (at least), a fact which can best be understood in terms of a "triple humped potential barrier", theoretically expected for an asymmetric, pearlike deformation of the excited compounds nucleus.

8957 **(CONF-8310228—1) Studies of fast neutron inelastic scattering to vibrational states of the actinide nuclei ^{232}Th and ^{238}U by the Lowell Group (experimental and theoretical).** Sheldon, E. (Lowell Univ., MA (USA). Dept. of Physics). 1983. Contract AC02-79ER10344. 16p. NTIS, PC A02. Order Number DE84003708.

From 6. Soviet national conference on neutron physics; Kiev, USSR (10 Oct 1983).

Paper copy only, copy does not permit microfiche production.

A survey is presented of the Lowell group's latest experimental and theoretical results for the inelastic scattering of fast neutrons to vibrational states of the deformed actinide nuclei ^{232}Th and ^{238}U. Excitation functions are shown from 0.8 to 2.5 MeV; angular distributions have been determined at 1.2 MeV and 1.5 MeV. The theoretical curves have been calculated using the standard (CN + DI) and unified (statistical S-matrix) formalisms. Generally good agreement has been found to prevail between experimental and theoretical data. 54 references.

8958 **(FRNC-TH—1149) Kinetic energy distribution of uranium 233 and 235 thermal fission fragments close to symmetry.** Djamel Belhafaf. (Grenoble-1 Univ., 38 (France)). Apr 1981. 98p. (In French). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84700204.

Experimental results are given for the kinetic energy distributions of ^{233}U and ^{235}U fission fragments in the symmetrical mass region, which is of particular significance because of the physical features expected to appear on going from an asymmetric configuration towards a symmetrical division. The Lohengrin mass spectrometer, with very high mass and energy resolution, provides an excellent means of making these measurements. A summary of various theoretical models, including the Wilkins "statistical model of the break point", is followed by an account of our results, which show very large variances of the initial total kinetic energy distribution near the 111:125 division. The change in the form of the break as one goes from an asymmetric configuration towards a symmetrical division is directly related to the difference between the initial total kinetic energy values given by our results for ^{233}U at 26 MeV and ^{236}U at 30 MeV.

8959 (INIS-mf—8299, pp 106-107) **Distribution of Gamow-Teller strength in ^{209}Bi - a probe for the charge distribution in ^{208}Pb.** Grotz, K.; Klapdor, H.V.; Metzinger, J. (Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.)); Madey, R.; Pairsuwan, W.; Anderson, B.D.; Baldwin, A.R.; Flanders, B.; Lebo, C.; Watson, J.W. (Kent State Univ., OH (USA)). 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphyik: Annual report 1982.

Comparison of the calculated Gamow-Teller (GT) strength distribution in ^{209}Bi with the measured (p,n) spectrum suggests evidence for ground state correlations in ^{208}Pb, which recently were also claimed to be required for an understanding of the charge distribution of lead.

8960 (INIS-mf—8299, pp 153) **Muon-induced fission from the isomeric state in ^{243}Pu.** Kam, J. de; Wolschin, G. 1983. NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

8961 (INIS-mf—8299, pp 154) **Muon induced fission of ^{238}U.** Blin, A.H.; Wolschin, G. 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

8962 (INIS-mf—8299, pp 78-79) **Investigation of fast fission on the ^{35}Cl + ^{238}U system.** Leray, S.; Gregoire, C.; Mazur, C.; Ngo, C.; Ribrag, M.; Tomasi, E. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)); Fan, G.Y. (Academia Sinica, Lanchow (China). Inst. of Modern Physics); Sanderson, N.E. (Science and Engineering Research Council, Daresbury (UK). Daresbury Lab.); Wolski, R. (Institute of Nuclear Physics, Krakow (Poland)); Ho, H. 1983. NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

The study of fast fission phenomena was continued with the ^{35}Cl + ^{238}U system for bombarding energies from 240 to 350 MeV. In contrast to other systems the FWHM of symmetric fragmentation does not increase with bombarding energy.

8963 (INIS-mf—8299, pp 93-94) **^{238}U(e,e'f) coincidence experiments on the E2/E0 strength distribution in the fission channel of ^{238}U.** Knoepfle, K.T. (Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.)); Bibber, K. van; Countryman, P.; Furnstahl, R.; Griffioen, K.A.; Yearian, M.R. (Stanford Univ., CA (USA). High-Energy Physics Lab.); Calarco, J.R. (New Hampshire Univ., Durham (USA)); Rowley, D.; Woodsworth, J.G. (California Univ., Livermore (USA). Lawrence Livermore National Lab.). 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

At the Stanford Superconducting Recyclotron, spectra of inelastically scattered electrons from ^{238}U have been measured in coincidence with fission fragments detected in an array of parallel plate avalanche counters. Incident beam energies of 80 and 118 MeV were selected such that the corresponding momentum transfers (q = 0.21 und 0.41 fm^{-1} at THETAsub(e') = 40°) correspond to maxima of the E1 and E2 form factors. Using collective form factors to separate E1, E2/E0 contributions, the deduced E1 absorption satisfactorily reproduces the results of photonuclear work, whereas the E2/E0 component shows a continuum of strength with a compact resonance at Esub(x) proportional 9.5 MeV.

8964 (INIS-mf—8299, pp 118-120) **γ-spectroscopy in the second minimum of ^{238}U and ^{240}Pu.** Albrecht, R.; Kolb, B.; Simon, R.S. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)); Habs, D.; Helmer, K.; Helmolt, U. v.; Heyng, H.W.; Krieger, H.; Pelte, D.; Schwalm, D. (Heidelberg Univ. (Germany, F.R.). Physikalisches Inst.). 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphyik: Annual report 1982.

γ transitions preceding the fission decay of the shape isomers in ^{238}U and ^{240}Pu have been measured with the crystal ball. Lines at 616 keV and 808 keV are observed in ^{238}U and ^{240}Pu, respectively, which are tentatively interpreted as deexcitations of the β vibrational band in the second minimum.

8965 (INIS-mf—8307, pp 164) **Positron and electron-spectroscopy in deep inelastic reactions.** Kankeleit, E. (Technische Hochschule Darmstadt (Germany, F.R.). Inst. fuer Kernphysik). 1983. NTIS (US Sales Only), PC A11/MF A01. (CONF-830118—).

From 11. international workshop on gross properties of nuclei and nuclear excitations; Hirschegg, Austria (17 Jan 1983).

Published in summary form only.

8966 (INIS-mf—8307, pp 16-20) **Heavy actinide products from reactions with ^{254}Es. Results and prospects.** Schaedel, M.; Lougheed, R.W.; Landrum, J.H.; Wild, J.F.; Dougan, R.J.; Hoover, A.D.; Hulet, E.K. (California Univ., Livermore (USA). Lawrence Livermore National Lab.); Bethune, G.R. (Bethune-Cookman Coll., Daytona Beach, FL (USA)); Ghiorso, A.; Nurmia, M.J. 1983. NTIS (US Sales Only), PC A11/MF A01. (CONF-830118—).

From 11. international workshop on gross properties of nuclei and nuclear excitations; Hirschegg, Austria (17 Jan 1983).

From the first series of experiments we obtained cross sections for Fm and Md isotopes and ^{259}No from the reactions of 121-MeV ^{22}Ne, 126-MeV ^{22}Ne and 98-MeV ^{18}O with ^{254}Es.

8967 (INIS-mf—8664, pp 71) **Measurement of prompt fission neutrons from ^{205}Tl bombardement by 118 MeV alpha particles.** Jasicek, H.; Mersits, E.; Riehs, P. (Atominstitut der Oesterreichischen Universitaeten, Vienna); Mueller, H.H.; Reichart, W.; Schober, P.; Steiner, S. (Zurich Univ. (Switzerland)); Lewandowski, Z.; Wagner, R. (Basel Univ. (Switzerland)). 1982. (In German). NTIS (US Sales Only), PC A05/MF A01. (CONF-8209185—).

From Annual conference of the Austrian Physical Society; Graz, Austria (22 Sep 1982).

Published in summary form only.

8968 (INIS-SU—125, pp 134) **^{223}Rn gamma spectrum.** Brudanin, V.B.; Vylov, Ts.; Golovkov, N.A.; Gromova, I.I.; Dzhelepov, B.S.; Ivanov, A.I.; Ivanov, R.B.; Mikhajlova, M.A.; Norseev, Yu.V. 1982. (In Russian). NTIS (US Sales Only), PC A25/MF A01. (CONF-820391—Summ.).

From 32. conference on nuclear spectroscopy and nuclear structure; Kiev, Ukrainian SSR (16 Mar 1982).

8969 **(JAERI-M—82-096) Evaluation of neutron nuclear data for ^{241}Am and ^{243}Am.** Kikuchi, Yasuyuki. (Japan Atomic Energy Research Inst., Tokyo). Aug 1982. 109p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE83704091.

Neutron nuclear data of ^{241}Am and ^{243}Am were evaluated for JENDL-2. Evaluated quantities are the total, elastic and inelastic scattering, fission, capture, (n,2n), (n,3n) and (n,4n) reaction cross sections, the resolved and unresolved resonance parameters, the angular or energy distribution of the emitted neutrons, and the average number of neutrons emitted per fission. The fission cross section was evaluated on the basis of newly measured data, and lower values than JENDL-1 were given in the subthreshold energy region. The reliability of the calculation parameters are also much improved, because experimental data became available for the total and capture cross sections of ^{241}Am in the high energy region.

8970 **(LA-UR—83-3531) Status of fission yield evaluations.** England, T.R.; Rider, B.F. (Los Alamos National Lab., NM (USA)). 1983. Contract W-7405-ENG-36. 33p. (CONF-8310104—7). NTIS, PC A03/MF A01. Order Number DE84004372.

From Specialists meeting on yields and decay data of fission product nuclides; Upton, NY, USA (24 Oct 1983).

Very few yield compilations are also evaluations, and very few contain an extensive global library of measured data and extensive models for unmeasured data. The earlier U.K. evaluations and US evaluations were comparable up to the retirements of the primary evaluators. Only the effort in the US has been continued and expanded. The previous U.K. evaluations have been published. In this paper we summarize the current status of the US evaluation, philosophy, and various integral yield tests for 34 fissioning nuclides at one or more neutron incident energies and/or for spontaneous fission. Currently there are 50 yield sets and for each we have independent and cumulative yields and uncertainties for approximately 1100 fission products. When finalized, the recommended data will become part of the next version of the US Evaluated Nuclear Data File (ENDF/B-VI). The complete set of data, including the basic input of measured yields, will be issued as a sequel to the General Electric evaluation reports (better known by the authors' names: Rider - or earlier - Meek and Rider). 16 references.

8971 (NEANDC—158-U, pp 209-210) **Sensitivity of the critical mass, calculated for ^{242}Pu to the neutron inelastic scattering cross section.** Frehaut, J. (Centre d'Etudes de Bruyeres-le-Chatel, 92 - Montrouge (France)). 1982. (In French). NTIS (US Sales Only), PC A11/MF A01. (CONF-811161—).

From Specialist meeting on fast neutron scattering on actinide nuclei; Paris, France (23 Nov 1981).

8972 **(NEANDC—158-U) Fast neutron scattering on actinide nuclei.** (Nuclear Energy Agency, 75 - Paris (France)). 1982. 233p. (In French, English). (CONF-811161—). NTIS (US Sales Only), PC A11/MF A01. Order Number DE83704074.

From Specialist meeting on fast neutron scattering on actinide nuclei; Paris, France (23 Nov 1981).

More and more sophisticated neutron experiments have been carried out with better samples in several laboratories and it was necessary to intercompare them. In this respect, let us quote for example (n,n'e) and (n,n'γ) measurements. Moreover, high precision (p,p), (p,p') and (p,n) measurements have been made, thus supplementing neutron experiments in the determination of the parameters of the optical model, still widely used to describe the neutron-nucleus interaction. The optical model plays a major role and it is therefore essential to know it well. The spherical optical model is

still very useful, especially because of its simplicity and of the relatively short calculation times, but is obviously insufficient to treat deformed nuclei such as actinides. For accurate calculations about these nuclei, it is necessary to use a deformed potential well and solve a set of coupled equations, hence long computational times. The importance of compound nucleus formation at low energy requires also a good knowledge of the statistical model together with that of all the reaction mechanisms which are involved, including fission for which an accurate barrier is necessary and, of course, well-adjusted level densities. The considerations form the background of the Scientific Programme set up by a Programme Committee whose composition is given further on in this book.

8973 (NEANDC—158-U, pp 69-95) **Neutron optical model in the actinide region.** Hodgson, P.E. (Nuclear Physics Laboratory, Oxford (UK)). 1982. NTIS (US Sales Only), PC A11/MF A01. (CONF-811161—).

From Specialist meeting on fast neutron scattering on actinide nuclei; Paris, France (23 Nov 1981).

The usefulness of the simple optical model for calculating neutron cross-sections in the actinide region is assessed. Comparisons are made between many proposed sets of optical model parameters and the experimental data, and an optimum set is selected. The dependence of the potential on the incident energy and on the nuclear asymmetry and deformation is discussed, and several ways of improving this set are proposed. The usefulness of the simple optical model is compared with that of the coupled-channels method and a new way of calculating inelastic cross-sections is proposed.

8974 (NEANDC—158-U, pp 96-115) **Application of the coupled-channel optical model for the prediction of fast neutron scattering cross sections with special emphasis on odd actinides.** Lagrange, C. (Centre d'Etudes de Bruyeres-le-Chatel, 92 - Montrouge (France)). 1982. (In French). NTIS (US Sales Only), PC A11/MF A01. (CONF-811161—).

From Specialist meeting on fast neutron scattering on actinide nuclei; Paris, France (23 Nov 1981).

The application of the coupled-channel optical model to the calculations of reaction and direct interactions cross sections on actinide nuclei is presented. One of the most important reasons for paying particular attention to the optical model parameterisation is the obtention of a parameter set suited for extrapolation to neighbouring nuclei. The various methods used to determine a coherent set of parameters within the whole energy range 10 keV - 20 MeV are discussed. The parameterisation thus obtained for even-A nuclei can serve as a guide for the odd-A ones. The procedures used for calculating neutron cross sections for odd-A nuclei: ^{233}U, ^{235}U, ^{237}Np, ^{239}Pu, ^{241}Am are commented. A special consideration is given to the compound nucleus formation cross sections and the neutron penetrabilities in the energy range 10 keV - 5 MeV considered as very important for applied purposes.

8975 (NEANDC—158-U, pp 145-168) **Use of the statistical model for the calculation of compound nucleus contributions to inelastic scattering on actinide nuclei.** Arthur, E.D. (Los Alamos National Laboratory, NM (USA)). 1982. NTIS (US Sales Only), PC A11/MF A01. (CONF-811161—).

From Specialist meeting on fast neutron scattering on actinide nuclei; Paris, France (23 Nov 1981).

The application of the Hauser-Feshbach statistical model to the calculation of compound nucleus contributions to inelastic scattering cross sections on actinide nuclei is discussed. The inelastic cross sections obtained in this manner depend strongly upon the constraints introduced by competing channels as well as the direct influence of neutron penetrabilities and level density expressions used to describe neutron emission. The basic Hauser-Feshbach model is discussed, particularly with respect to width-fluctuation and correlation corrections that must be applied at lower energies. Since the fission channel is often a principal competitor to neutron emission, its representation within the double-humped barrier model is described. Possible enhancements of the level density at the fission saddle points are discussed, along with their possible effect on calculated (n,f) cross sections. Likewise, level density models employed for continuum inelastic calculations are reviewed, particularly with respect to the uncertainties they can introduce into calculated results. Finally, the extension of such calculations to higher energies where preequilibrium corrections must be applied is discussed.

8976 (NEANDC—158-U, pp 169-197) **Evaluation of (n,n') scattering cross sections from 0.8 to 2.5 MeV for higher collectivebands of ^{232}Th and ^{238}U in "standard" (CN + DI) and "unified" (Weidenmueller S-matrix) formalisms.** Sheldon, E.; Chan, D.W.S. (University of Lowell, MA (USA)). 1982. NTIS (US Sales Only), PC A11/MF A01. (CONF-811161—).

From Specialist meeting on fast neutron scattering on actinide nuclei; Paris, France (23 Nov 1981).

Angle-integrated cross sections for inelastic scattering of fast neutrons from 0.8 to 2.5 MeV on ^{232}Th and ^{238}U, proceeding to higher collective (quadrupole and octupole vibrational) states in the residual nuclei, have been computed in a "standard" and a "unified" approach; the resulting excitation functions have been compared with the experimental data of the Lowell group. In all calculations, a consistent set of optical potential and deformation parameters, as derived by Haouat and Lagrange of the Bruyeres group, was used. The "standard" formalism employed an incoherent sum of compound-nucleus (CN) and coupled-channel direct-interaction (DI) cross sections, evaluated with the programmes "CINDY" and "KARJUP" (Karlsruhe version of "JUPITOR") respectively. Provision was made for the effect of level-width fluctuations and for competing neutron exit channels. The results in general compared well with the measured values, but in several instances disagreed significantly with the ENDF/B-V evaluated data. Still better agreement ensued from the use of the "unified" formalism based upon energy-averaged second moments of transformed S-matrix elements in a statistical approach developed by Weidenmueller et al. and embodied within a new fluctuation programme 'NANCY" with coupled channels and competing channels to generate and manipulate the grand ensemble of S-matric elements. With only the coupling strengths as adjustable parameters, this offers a promising, reliable means of analysis well suited to the interpretation of neutron scattering on deformed actinide nuclei.

8977 (NEANDC—158-U, pp 27-46) **Cross section data on fast neutron elastic and inelastic scattering from actinide nuclei.** Haouat, G. (Centre d'Etudes de Bruyeres-le-Chatel, 92 - Montrouge (France)). 1982. (In French). NTIS (US Sales Only), PC A11/MF A01. (CONF-811161—).

From Specialist meeting on fast neutron scattering on actinide nuclei; Paris, France (23 Nov 1981).

Fast neutron elastic and inelastic scattering data on actinide nuclei and techniques relevant to their measure are reviewed. Particular attention is given to high resolution experiments dealing with the excitation of well defined levels since the resulting data are of major importance for model calculations and evaluations. The experimental procedures are discussed and their large impact on the accuracy and on the quality of the data is stressed. Selected cross section data are presented to illustrate the performances as well as the limits of presently available experimental techniques. Ways of improving these techniques are proposed.

8978 (NEANDC—158-U, pp 47-68) **Review of (n,n',γ) cross-section data on actinide nuclei.** Olsen, D.K. (Oak Ridge National Laboratory, TN (USA)). 1982. NTIS (US Sales Only), PC A11/MF A01. (CONF-811161—).

From Specialist meeting on fast neutron scattering on actinide nuclei; Paris, France (23 Nov 1981).

The available high-resolution (n,n',γ) cross section data on actinide nuclei, essentially ^{235}U and ^{232}Th, are reviewed by dividing the measurement process into two steps. First, the measurement of discrete photon production cross sections is discussed by comparing white and monoenergetic neutron source techniques. Resultant cross sections are compared and their accuracies assessed. Second, the step of inferring inelastic scattering cross sections from photon production cross sections is discussed with particular emphasis on the problems connected with monopole transitions, low-energy transitions, prompt fission photons, and simple rotational models. The uncertainties introduced in this step are probably larger than those of the first.

8979 (NEANDC—158-U, pp 198-208) **Recent neutron scattering work at the University of Lowell.** Kegel, G.H.R.; Ciarcia, C.A.; Couchell, G.P.; Egan, J.J.; Mittler, A.; Pullen, D.J.; Schier, W.A.; Shao, J. (University of Lowell, Massachusetts (USA)). 1982. NTIS (US Sales Only), PC A11/MF A01. (CONF-811161—).

From Specialist meeting on fast neutron scattering on actinide nuclei; Paris, France (23 Nov 1981).

Neutron elastic and inelastic scattering cross sections of ^{230}U and ^{232}Th have been measured at the University of Lowell for states below 1.8 MeV. A time-of-flight (TOF) spectrometer was used. The disc-shaped scatterer was oriented to optimize energy resolutions for 200-to-500-keV neutrons. Neutrons were obtained via the ^{7}Li(p,n)^{7}Be reaction. Targets were prepared by in-situ evaporation of Li onto a Ta backing. During the evaporation, the target thickness was monitored using a 5-m-flight-path TOF spectrometer; a typical target had a neutron thickness from 8 to 10 keV for Esub(p) = 2.25.MeV. Spectra were analyzed using the unfolding code TINA; standard peak shapes were obtained from codes LAGUE and LAPA. Results obtained will be presented.

8980 (NEANDC—158-U, pp 211-220) **Report of the Workshop on scattering from even actinides.** Smith, A.B. (Argonne National Laboratory, IL (USA)). 1982. NTIS (US Sales Only), PC A11/MF A01. (CONF-811161—).

From Specialist meeting on fast neutron scattering on actinide nuclei; Paris, France (23 Nov 1981).

The workshop addressed neutron scattering and associated processes in the even actinides ^{232}Th, ^{238}U, ^{240}Pu and, to a lesser extent, ^{242}Pu. The relevant energy range was from the inelastic scattering threshold to 20 MeV. The discussion proceeded by reaction type, first addressing neutron total cross sections and then turning to elastic- and inelastic-scattering processes.

8981 (NEANDC—158-U, pp 221-233) **Conclusions on the workshop on the odd-Z or odd-A actinides.** Lachkar, J. (Centre d'Etudes de Bruyeres-le-Chatel, 92 - Montrouge (France)). 1982. (In French). NTIS (US Sales Only), PC A11/MF A01. (CONF-811161—).

From Specialist meeting on fast neutron scattering on actinide nuclei; Paris, France (23 Nov 1981).

The present status of experimental, theoretical and evaluated data for odd-Z or odd-A actinides has been reviewed. For poorly known nuclei - ^{237}Np, ^{241}Am and ^{241}Pu - new experimental data needed to improved further evaluations have been listed. For ^{233}U, ^{235}U and ^{239}Pu substantial progress might be done in both measurements and evaluations. Also microscopic calculations are worthwile in order to confirm the deformation parameters of odd nuclei. The highest priority request remains the inelastic scattering cross section for ^{239}Pu. On the other hand ^{233}U appears to be a good candidate for a complete study of the scattering properties on odd-A actinides.

8982 **High resolution photofission measurements using proton capture gamma rays.** Yeh, T.R.; Lancman, H. (Brooklyn College, Brooklyn, NY 11210). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-28: No. 2, 1289-1291(Apr 1981). (CONF-801111—). Contract AC02-79ER10452.

From 6. conference on application of accelerators in research and industry; Denton, TX, USA (3 Nov 1980).

High intensity proton beams from the Dynamitron at Brooklyn College are used to generate monochromatic gamma rays from known (p,Γ) resonances in various nuclei. The gamma rays, whose energy varies continuously as a function of the angle with the proton beam, are used in turn to measure photofission cross sections in ^{238}U and ^{232}Th. The number of suitable (p,Γ) resonances is sufficient to cover the 5 - 13 MeV range of excitation energy with an average step of about 100 keV. For a resonance of average strength the yield is 10^{3} photons per μA of protons on target. The energy spread is typically 20 - 40 keV and a gamma ray energy resolution of 200 eV can easily be reached. This resolution is adequate for investigating structure in the photofission cross sections resulting from class II states in the second well of the fission barrier.

8983 **Recent results of neutron inelastic scattering to higher-excited levels in ^{232}Th and ^{238}U.** Couchell, G.P.; Ciarcia, C.; Egan, J.J.; Kegel, G.H.R.; Mittler, A.; Pullen, D.J.; Schier, W.A.; Shao, J. (Univ. of Lowell, MA). pp 45-50 of Nuclear data for science and technology. Boeckhoff, K.H. (ed.). New York, NY; Unipub (1974).

Neutron inelastic scattering cross sections for levels of ^{232}Th and ^{238}U between 680 and 1200 keV excitation energy have been measured in the neutron energy range 0.9 to 1.5 MeV. Nearly monoenergetic neutrons were generated using the ^{7}Li(p,n) reaction initiated by a pulsed proton beam produced by a Van de Graaff accelerator using terminal pulsing in conjunction with a Mobley bunching system. Scattered neutrons were observed with a time-of-flight spectrometer with experimental parameters chosen to yield an overall energy resolution of 12 to 15 keV for inelastically scattered neutrons. Level cross sections were deduced from measured 125°-differential scattering cross sections. Excitation functions were compared with our own previous (n,n′γ) measurements, recent theoretical calculations and the ENDF/B-V evaluations. [^{232}Th(n,n′), ^{238}U(n,n′), σ(E/sub n/, θ = 125°, E/sub n/ = 0.9 to 1.5 MeV, neutron time-of-flight; deduced level cross sections, estimated EO branching ratios].

6530 Nuclear Theory

REFER ALSO TO CITATION(S) 8810, 9068

8984 **(CEA-CONF—6613) Hot interaction potentials.** Ngo, C.; Chen, X.S.; Tomasi, E.; Barranco, M.; Pi, M.; Vinas, X.; Ngo, H. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Jan 1983. 30p. (CONF-830117—7). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83704067.

From 21. international winter meeting on nuclear physics; Bormio, Italy (24 Jan 1983).

We review some finite temperature effects in heavy ion reactions using the modified Skyrme interaction and the Thomas Fermi approximation. We have calculated nuclear densities at finite temperature and used them for computing the interaction potentials of two hot heavy ions, and in the interaction potentials of p+A* and α+A* systems (A* is an excited nucleus). A consequence of finite temperature effects is a lowering of the Coulomb barrier and an enhancement of fusion cross sections as it is shown in a dynamical calculation.

8985 **(CEA-CONF—6614) Nucleon currents and frictional forces between highly excited nuclei.** Barranco, M.; Pi, M.; Vinas, X.; Ngo, C.; Tomasi, E. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Jan 1983. 23p. (CONF-830117—8). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704068.

From 21. international winter meeting on nuclear physics; Bormio, Italy (24 Jan 1983).

A finite temperature Thomas-Fermi method has been used to study the nucleon transfer between two hot slabs of symmetric nuclear matter. Special attention has been paid to temperature effects neglected in earlier calculations. As a result, closed and ready-to-use formulas for the exchange and transfer nucleon flux at zero relative momentum are given as a function of the temperature T. We also present a rather detailed discussion of thermal properties of the semi-infinite slabs.

8986 (INIS-mf—8299, pp 109-111) **Beta decay and the age of the galaxy.** Thielemann, F.K.; Metzinger, J.; Klapdor, H.V. 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphyik: Annual report 1982.

Beta-delayed neutron emission and beta-delayed fission probabilities (Psub(n) and Psub(βdf)) were calculated for neutron-rich nuclei between the beta stability line and the neutron-drip line in the range 10 <= Z <= 100 and 75 <= Z <= 100, respectively. Astrophysical r-process calculations were performed including the calculated Psub(n) and Psub(βdf) values. This puts the method to determine the age of the Galaxy by the actinide chronometers on a reliable basis. An excellent overall agreement with the observed r-

abundance distribution is obtained. The predicted r-process production ratios for the chronometric pairs $^{232}Th/^{238}U$, $^{235}U/^{238}U$, and $^{244}Pu/^{238}U$ result in an age of the Galaxy of tsub(G) = (20.8sub(-4)$^{+2}$) x 10^9 a, which is by almost a factor two larger than earlier predictions by this method, but in accordance with recent astronomical observations from globular clusters. The predicted island of 100% β-delayed fission around Z = 94, N = 168 acts as a sink to the r-process with the consequence that no superheavy elements are produced in nature.

8987 (INIS-mf—8299, pp 148) **Beyond the statistical model: Recent progress in neutron nuclear reaction theory.** Weidenmueller, H.A. 1983. NTIS (US Sales Only), PC A11/MF A01.
In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

8988 (INIS-mf—8299, pp 148) **Nuclear response time in precompound reactions.** Kawai, M. (Kyushu Univ., Fukuoka (Japan). Dept. of Physics); Weidenmueller, H.A. 1983. NTIS (US Sales Only), PC A11/MF A01.
In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

8989 (INIS-mf—8299, pp 148-150) **Possibility of measuring the nuclear correlation width GAMMA via atomic electron spectroscopy.** Kienle, P. (Technische Univ. Muenchen (Germany, F.R.)); McVoy, K.W. (Wisconsin Univ., Madison (USA)); Koenig, W.; Weidenmueller, H.A. 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.
In Max-Planck-Institut fuer Kernphysik: Annual report 1982.
The correlation width GAMMA of the autocorrelation function of the nuclear scattering matrix, usually determined through the analysis of Ericson fluctuations of nuclear cross sections, manifests itself also in the spectra of atomic electrons ejected coherently prior to and after nuclear scattering. We propose to determine GAMMA from a coincidence measurement between nuclear reaction products and atomic electrons, a method which does not require good energy resolution of the incident beam, and which would make it possible to measure GAMMA in a range of values not accessible before.

8990 (INIS-mf—8299, pp 150) **Are there any deviations from the Gaussian distribution of reduced partial widths.** Hofmann, H.M.; Mertelmeier, T. (Erlangen-Nuernberg Univ., Erlangen (Germany, F.R.). Inst. fuer Theoretische Physik); Weidenmueller, H.A. 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.
In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

8991 (INIS-mf—8299, pp 150-151) **Effective interactions at low and intermediate energy.** Mahaux, C. (Liege Univ. (Belgium)). 1983. NTIS (US Sales Only), PC A11/MF A01.
In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

8992 (INIS-mf—8299, pp 151) **Microscopic description of giant resonances in highly excited nuclei.** Sommermann, H.M. 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.
In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

8993 (INIS-mf—8299, pp 151) **Influence of dynamical effects on the energy of giant resonances.** Mahaux, C. (Liege Univ. (Belgium)); Sommermann, H.M. 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.
In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

8994 (INIS-mf—8299, pp 152) **Realistic calculations of excitations in infinite Fermi matter.** Sandler, D.G. (Illinois Univ., Urbana (USA). Dept. of Physics); Kwong, N.H. 1983. NTIS (US Sales Only), PC A11/MF A01.
In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

8995 (INIS-mf—8299, pp 152) **Effects of configurations with two particles in the continuum in reaction problems.** Ibarra, R.H.; Zhang, J.S. 1983. NTIS (US Sales Only), PC A11/MF A01.
In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

8996 (INIS-mf—8299, pp 152) **Effect of the collision term in nucleus-nucleus collisions.** Grange, P.; Wolschin, G. 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.
In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

8997 (INIS-mf—8299, pp 153) **Induced nuclear fission viewed as a fission process: a study of transients.** Grange, P. (Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires); Li, J.Q. (Lanzhou Univ. (China). Inst. of Modern Physics); Weidenmueller, H.A. 1983. NTIS (US Sales Only), PC A11/MF A01.
In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

8998 (INIS-mf—8299, pp 153) **Application of empirical heavy ion potentials to heavy ion transfer.** Ibarra, R.H. 1983. NTIS (US Sales Only), PC A11/MF A01.
In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

8999 (INIS-mf—8299, pp 153) **Dissipation and fluctuation caused by statistical particle exchange.** Spangenberger, H. (Technische Hochschule Darmstadt (Germany, F.R.). Inst. fuer Kernphysik); Feldmeier, H. 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.
In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

9000 (INIS-mf—8299, pp 154) **Angular momentum distributions in heavy ion reactions.** Li, J.Q.; Wolschin, G. 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.
In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

9001 (INIS-mf—8299, pp 155) **Deuteron production in high energy nucleus-nucleus interactions.** Aichelin, J.; Huefner, J. 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.
In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

9002 (INIS-mf—8299, pp 155) **Particle production in hadron-nucleus collisions around 100 GeV.** Chao, W.Q.; Hegab, M.K.; Huefner, J. 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.
In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

9003 (INIS-mf—8299, pp 155) **High energy protons can break nuclei into pieces.** Bohrmann, S.; Huefner, J.; Nemes, M.C. 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.
In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

9004 (INIS-mf—8299, pp 155) **Backward emission of heavy fragments in high energy proton-nucleus reactions.** Huefner, J.; Sommermann, H.M. 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.
In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

9005 (INIS-mf—8299, pp 156) **Implications on the chiral bag model from the deuteron asymptotic d-state.** Kam, J. de. 1983. NTIS (US Sales Only), PC A11/MF A01.
In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

9006 (INIS-mf—8307, pp 106) **Fusion and transfer reactions at heavy ion collisions between 7.5 and 20 MeV/nucleon.** Homeyer, H. (Hahn-Meitner-Institut fuer Kernforschung Berlin G.m.b.H. (Germany, F.R.)). 1983. NTIS (US Sales Only), PC A11/MF A01. (CONF-830118—).
From 11. international workshop on gross properties of nuclei and nuclear excitations; Hirschegg, Austria (17 Jan 1983).
Published in summary form only.

9007 (INIS-mf—8307, pp 132-134) **Nuclear shell structure from a quark-theoretical viewpoint.** Bleuler, K. 1983. NTIS (US Sales Only), PC A11/MF A01. (CONF-830118—).

From 11. international workshop on gross properties of nuclei and nuclear excitations; Hirschegg, Austria (17 Jan 1983).

The author describes the application of the quark model for the description of nuclear structure.

9008 (INIS-mf—8307, pp 135-152) **Dynamical calculation of thresholds for compound-nucleus formation.** Thomas, K.; Davies, R. (Oak Ridge National Lab., TN (USA). Physics Div.); Sierk, A.J.; Nix, J.R. (Los Alamos Scientific Lab., NM (USA). Theoretical Div.). 1983. NTIS (US Sales Only), PC A11/MF A01. (CONF-830118—).

From 11. international workshop on gross properties of nuclei and nuclear excitations; Hirschegg, Austria (17 Jan 1983).

It is our major purpose to calculate within a single unified model the dependence of the additional energy ΔE upon Z^2/A for various types of dissipation, in an effort to ultimately determine the magnitude and mechanism of nuclear dissipation from comparisons with experimental data. Since both our predictions and those of other groups depend somewhat upon the details of the model, we also study the effect of the shape parametrization on the dynamical thresholds.

9009 (INIS-mf—8307, pp 182-186) **Quarkochemistry of the heavy ion reactions.** Biro, T.S.; Zimanyi, J. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). 1983. NTIS (US Sales Only), PC A11/MF A01. (CONF-830118—).

From 11. international workshop on gross properties of nuclei and nuclear excitations; Hirschegg, Austria (17 Jan 1983).

In this paper we briefly review the theoretical bases of the formation of quark gluon plasma from nuclear matter and we point out some essential consequence of the finite time and space structure of a heavy ion collision. We also review the results of the quarkochemistry for the central, symmetric energetic heavy ion reactions. We suggest a systematic comparison between hadrochemical and quarkochemical models and experimental results in order to find the signature of the quark matter.

9010 (INIS-mf—8307, pp 187-194) **Neck particles from heavy-ion collisions.** Brosa, U.; Grossmann, S. (Marburg Univ. (Germany, F.R.). Fachbereich Physik). 1983. NTIS (US Sales Only), PC A11/MF A01. (CONF-830118—).

From 11. international workshop on gross properties of nuclei and nuclear excitations; Hirschegg, Austria (17 Jan 1983).

The authors explain some experimental observations in heavy ion reactions by a hydrodynamic approach using the collisions of two droplets.

9011 (INIS-mf—8307, pp 195-198) **Quantum-mechanical model for the one-sided flux.** Gnucci, C.; Stancu, F. (Liege Univ. (Belgium). Inst. de Physique); Wilets, L. (Washington Univ., Seattle (USA). Dept. of Physics). 1983. NTIS (US Sales Only), PC A11/MF A01. (CONF-830118—).

From 11. international workshop on gross properties of nuclei and nuclear excitations; Hirschegg, Austria (17 Jan 1983).

We propose a quantum-mechanical model for calculating the static one-sided flux used in describing dissipation in heavy ion collisions. The colliding nuclei are represented by two equal cubic boxes communicating through a window of variable size. The one-sided flux is calculated from single particle wave functions of occupied states obtained by solving the Schroedinger equation with boundary conditions imposed by the model.

9012 (INIS-mf—8307, pp 199-204) **Macroscopic implications of diverse mechanisms for dinuclear (N-Z) evolution.** Goekmen, A.; Dworzecka, M.; Griffin, J.J. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy). 1983. NTIS (US Sales Only), PC A11/MF A01. (CONF-830118—).

From 11. international workshop on gross properties of nuclei and nuclear excitations; Hirschegg, Austria (17 Jan 1983).

Discrete Random Walk calculations of the (N-Z) evolution of a liquid drop dinucleus are reported for various assumptions about the transfer dynamics. Transition probabilities are assumed which correspond to the transferred nucleon's being able to reach (a) any energy conserving state of the final dinucleus, (b) any energy conserving state more complicated by not more than 1p and 1h than the initial state, and (c) any one-particle one-hole excitation of the initial state. Physically these assumptions correspond to restricting the transfer, not at all, somewhat, and totally to be a pure one-body process. In every case, the Pauli exclusion principle is honored in the allowed final states. One finds that the assumption (c) generally leads to predictions easily distinguishable from those of (a) and (b), which do not differ substantially.

9013 (INIS-mf—8664, pp 32) **Muon induced deuterium-deuterium fusion. Temperature dependence and multiple catalysis.** Breunlich, W.H.; Cargnelli, M.; Fuhrmann, H.; Kammel, P.; Marton, J.; Pawlek, P.; Strehl, T.; Werner, J.; Zmeskal, J. (Oesterreichische Akademie der Wissenschaften, Vienna); Bertl, W.H. (Eidgenoessische Technische Hochschule, Zurich (Switzerland)). 1982. (In German). NTIS (US Sales Only), PC A05/MF A01. (CONF-8209185—).

From Annual conference of the Austrian Physical Society; Graz, Austria (22 Sep 1982).

Published in summary form only.

9014 (INIS-mf—8664, pp 74) **Electron-deuteron-observable for the GRAZ II potential.** Mathelitsch, L.; Plessas, W.; Schwarz, K.; Zingl, H.F.K. (Graz Univ. (Austria). Inst. fuer Theoretische Physik). 1982. (In German). NTIS (US Sales Only), PC A05/MF A01. (CONF-8209185—).

From Annual conference of the Austrian Physical Society; Graz, Austria (22 Sep 1982).

Published in summary form only.

9015 (INIS-mf—8664, pp 75) **Core behaviour of separable N-N-potentials.** Gabler, K. (Graz Univ. (Austria). Inst. fuer Theoretische Physik). 1982. (In German). NTIS (US Sales Only), PC A05/MF A01. (CONF-8209185—).

From Annual conference of the Austrian Physical Society; Graz, Austria (22 Sep 1982).

Published in summary form only.

9016 (INIS-mf—8664, pp 76) **Separable approximation to the two-particle interaction.** Haidenbauer, J.; Plessas, W. (Graz Univ. (Austria). Inst. fuer Theoretische Physik). 1982. (In German). NTIS (US Sales Only), PC A05/MF A01. (CONF-8209185—).

From Annual conference of the Austrian Physical Society; Graz, Austria (22 Sep 1982).

Published in summary form only.

9017 (INIS-mf—8664, pp 76) **Pauli principle and shell effects in the Coulomb energy of mirror nuclei.** Eder, G. (Atominstitut der Oesterreichischen Universitaeten, Vienna). 1982. (In German). NTIS (US Sales Only), PC A05/MF A01. (CONF-8209185—).

From Annual conference of the Austrian Physical Society; Graz, Austria (22 Sep 1982).

Published in summary form only.

9018 (INIS-mf—8664, pp 77) **Microscopic calculation of the α-nucleus optical potential.** Leeb, H. (Technische Univ., Vienna (Austria). Inst. fuer Experimentelle Kernphysik); Osterfeld, F.; Dermann, H. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Kernphysik). 1982. (In German). NTIS (US Sales Only), PC A05/MF A01. (CONF-8209185—).

From Annual conference of the Austrian Physical Society; Graz, Austria (22 Sep 1982).

Published in summary form only.

9019 (INIS-mf—8664, pp 77) **Description of nuclear forces in the quark model.** Baier, H.; Eder, G.; Faber, M.E.; Leeb, H.; Markum, H.; Meinhart, M.; Oberhummer, H.; Schaden, M. (Technische Univ., Vienna (Austria). Inst. fuer Experimentelle Kernphysik). 1982. (In German). NTIS (US Sales Only), PC A05/MF A01. (CONF-8209185—).

From Annual conference of the Austrian Physical Society; Graz, Austria (22 Sep 1982).

Published in summary form only.

9020 (INIS-mf—8664, pp 77) **Form instability of rotating nuclei at finite temperatures.** Faber, M.E. (Technische Univ., Vienna (Austria). Inst. fuer Experimentelle Kernphysik); Ploszajczak, M. (Inst. fuer Kernphysik, Krakau (Poland)). 1982. (In German). NTIS (US Sales Only), PC A05/MF A01. (CONF-8209185—).

From Annual conference of the Austrian Physical Society; Graz, Austria (22 Sep 1982).

Published in summary form only.

9021 (INIS-mf—8664, pp 78) **Importance of two-body forces in high spin nuclei.** Markum, H.; Faber, M.E. (Atominstitut der Oesterreichischen Universitaeten, Vienna). 1982. (In German). NTIS (US Sales Only), PC A05/MF A01. (CONF-8209185—).

From Annual conference of the Austrian Physical Society; Graz, Austria (22 Sep 1982).

Published in summary form only.

9022 (INIS-mf—8664, pp 78) **Photo fission and wavefunction of the deuteron.** Crepinsek, L. (Technical Univ., Maribor (Yugoslavia)); Zingl, H.F.K. (Graz Univ. (Austria). Inst. fuer Theoretische Physik). 1982. (In German). NTIS (US Sales Only), PC A05/MF A01. (CONF-8209185—).

From Annual conference of the Austrian Physical Society; Graz, Austria (22 Sep 1982).

Published in summary form only.

9023 (INIS-mf—8664, pp 79) **Nucleon-nucleon scattering: results of a phase shift analysis.** Mathelitsch, L. (Graz Univ. (Austria). Klinik fuer Innere Medizin). 1982. (In German). NTIS (US Sales Only), PC A05/MF A01. (CONF-8209185—).

From Annual conference of the Austrian Physical Society; Graz, Austria (22 Sep 1982).

Published in summary form only.

9024 (IPNO-TH—82-42) **Semi-classical approach to nuclear surface properties: radial shapes and energies.** Krivine, H. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). 1982. 8p. (CONF-821065—2). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704070.

From Topical meeting on nuclear fluid dynamics ICTP; Trieste, Italy (11 Oct 1982).

Energy density formalism calculations in semi-infinite nuclear matter are performed. Analytical solution of the Euler equation is given. Geometrical properties of the density are studied. Surface and surface symmetry energies are calculated and simple compact formulae are given.

9025 (LSNN—82-02) **Symmetric fusion of heavy ions around the Coulomb barrier energy.** Royer, G.; Remaud, B. (Paris-11 Univ., 91 - Orsay (France). Centre de Spectrometrie Nucleaire et de Spectrometrie de Masse). 1983. 22p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750233.

Using the liquid drop model, we have performed a systematic study of the symmetric fusion with a neck degree of freedom and tunnelling effects, the nuclear potential being calculated with the proximity approach. Barrier heights and positions are in very good agreement with experimental data when they are known (light-medium systems); the recent experimental data of the reactions ^{58}Ni + ^{58}Ni and ^{64}Ni + ^{64}Ni are particularly investigated. For heavier systems double-humped fusion barriers and isomeric states are predicted which strongly limit the complete fusion probability.

9026 (NEANDC—158-U, pp 116-144) **Study of proton-induced reactions and correlation with fast neutron scattering.** Hansen, L.F. (Lawrence Livermore National Laboratory, CA (USA)). 1982. NTIS (US Sales Only), PC A11/MF A01. (CONF-811161—).

From Specialist meeting on fast neutron scattering on actinide nuclei; Paris, France (23 Nov 1981).

The generation of cross sections for fast neutron-nucleon interactions obtained from elastic and charge-exchange proton data is discussed in terms of the Lane model formalism. A general description of the interaction of nucleons with nuclei is presented in terms of the optical model and the extended (or coupled-channel) optical model, together with the relation of these models to microscopic calculations of the nucleon-nucleon interaction. Comparisons between neutron elastic data and calculations carried out with optical model potentials obtained from (p,p) and (p,n) data are presented for a large number of nuclei. The validity of the Lane model and the importance of coupled effects in the actinide region are shown in a detailed comparison of calculations for elastic and inelastic neutron differential cross sections and measurements for ^{232}Th and ^{238}U.

9027 **Overview of experimental tests of the interacting boson approximation (IBA).** Casten, R.F. (Brookhaven National Lab., Upton, NY). pp 369-399 of Contemporary research topics in nuclear physics. Feng, D.H.; Vallieres, M.; Guidry, M.W.; Riedinger, L.L. (eds.). New York, NY; Plenum Publishing Company (1982).

A broad overview is presented of the principal tests to date of the IBA, for both even and odd nuclei, and including the evidence concerning the possible existence of the recently proposed supersymmetries. Although some details are presented, the aim is rather to survey the principal characteristics of the model, to assess the overall quality and extent of the agreement with experiment, and to indicate where further testing would be most useful.

9028 **Nuclear science: basic research serving society.** Koonin, S.E. Berkeley, CA; University of California (1982). 26p. Contract AC03-76SF00098.

This booklet describes nuclear science - its past accomplishments and future directions - and gives just a few examples of the importance of nuclear science to other sciences, to technology, and to education.

6540 Radiation And Shielding Physics

REFER ALSO TO CITATION(S) 8073, 8082, 8323, 8971

9029 (DOE/EV/03798—61) **Biophysical studies related to energy generation. Progress report.** Green, A.E.S. (Florida Univ., Gainesville (USA). Dept. of Nuclear Engineering Sciences). Nov 1983. Contract AS05-76EV03798. 7p. NTIS, PC A02/MF A01. Order Number DE84003443.

We are now connecting our past work on spatial and spectral yields with the subsequent diffusion and chemical kinetics. The intent is to develop an understanding of the systematics of the spatial plumes of atoms, molecules, and free radicals surrounding an incident electron beam of arbitrary energy in the low energy regime. Once this is achieved it should be possible to convolute these results with the secondary electron distributions arising from various primary particles such as protons or heavy ions to obtain the distribution of chemical species surrounding the track of the primary particles. This constitutes a direct physical route for connecting radiation chemistry to the fundamentals of radiation physics at a basic atomic and molecular level. We are currently utilizing numerical techniques developed in studies of flames and rocket plumes.

9030 (FEI—1189) **GRUKON software package. Part 2. Control data.** Sinitsa, V.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1981. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704064.

The description of the structure of the job for the package of the GRUKON applied computer codes meant for calculating group microscopic constants on the basis of estimated neutron data is given. Considered in detail are the problems of data organization for punch card input: input order data structure, their punch card arrangement.

9031 (INIS-mf—8664, pp 71) **Proof of the spin superposition principle for neutrons.** Summhammer, J.; Badurek, G.; Rauch, H. (Atominstitut der Oesterreichischen Universitaeten, Vienna). 1982. (In German). NTIS (US Sales Only), PC A05/MF A01. (CONF-8209185—).

From Annual conference of the Austrian Physical Society; Graz, Austria (22 Sep 1982).

Published in summary form only.

9032 (INIS-mf—8664, pp 34) **Experimental proof of the quantum-mechanical superposition principle for neutrons.** Summhammer, J.; Badurek, G.; Rauch, H. (Atominstitut der Oesterreichischen Universitaeten, Vienna). 1982. (In German). NTIS (US Sales Only), PC A05/MF A01. (CONF-8209185—).

From Annual conference of the Austrian Physical Society; Graz, Austria (22 Sep 1982).

Published in summary form only.

9033 (INIS-mf—8664, pp 31) **Determination of stopping power of copper for protons.** Aumayr, F.; Bauer, P.; Geretschlaeger, M.; Huber, P.; Obermann, W.; Paul, H.; Semrad, D. (Johannes Kepler Univ., Linz (Austria)). 1982. (In German). NTIS (US Sales Only), PC A05/MF A01. (CONF-8209185—).

From Annual conference of the Austrian Physical Society; Graz, Austria (22 Sep 1982).

Published in summary form only.

9034 (ITEF—21(1982)) **Measurement of ultracold neutron storage time in a magnetic trap.** Abov, Yu.G.; Borovlev, S.P.; Vasil'ev, V.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1982. 14p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83704065.

The storage time of ultracold neutrons in axial magnetic trap with a simple singly connected confinement fields measured. It is shown that neutron storage is caused only by a magnetic field. Storage time attained is T=303+-37 s. The result obtained is in a satisfactory agreement with theoretical estimates of neutron storage time for purely magnetic confinement.

9035 (ORNL/RSIC—46) **Description of the DLC-99/HUGO package of photon interaction data in ENDF/B-V format.** Roussin, R.W.; Knight, J.R.; Hubbell, J.H.; Howerton, R.J. (Oak Ridge National Lab., TN (USA)). Dec 1983. Contract W-7405-ENG-26. 23p. (ENDF—335). NTIS, PC A02/MF A01. Order Number DE84004071.

A new photon interaction data library, DLC,-99/HUGO, is described. The library was prepared by incorporating newly evaluated data from the National Bureau of Standards with that from an existing data library, DLC-7F/HPICE, which is the ENDF/B-IV photon interaction data. It contains pair and triplet cross sections, photoelectric cross sections, and atomic form factors and the corresponding coherent scattering cross sections. Evaluated data in INDF/B-V format are provided for elements Z=1 to 100. The data package, available from the Radiation Shielding Information Center (RSIC) at Oak Ridge National Laboratory, will be submitted to CSEWG for consideration as the ENDF/B-V Photon Interaction Library. Two computer codes, EDPHOT for selectively printing the data and COMP23 for comparing two photon interaction libraries, are also provided.

9036 (ORNL/TM—8203) **Application of new techniques to ORELA neutron-transmission measurements and their uncertainty analysis: the case of natural nickel from 2 keV to 20 MeV.** Larson, D.C.; Larson, N.M.; Harvey, J.A.; Hill, N.W.; Johnson, C.H. (Oak Ridge National Lab., TN (USA)). Oct 1983. Contract W-7405-ENG-26. 123p. (ENDF—333). NTIS PC E05/MF A01. Order Number DE84002265.

Includes 1 sheet of 48x reduction microfiche.

The neutron transmission through a 2.54-cm sample of natural nickel has been measured for neutron energies between 2 keV and 20 MeV. Known background sources are described, and the methods used to correct for these backgrounds are presented. An in-depth uncertainty analysis is given for this measurement, with explicit formulas derived for each effect contributing to the cross-section uncertainty. Parameters uncertainties and correlations among the parameters describing the backgrounds, deadtime, and other sources of uncertainty are given. To obtain a covariance matrix for this measurement, the final cross-section results are binned into 15 energy groups, and covariance matrix is provided for this 15-group set. We find that the largest contributions to the cross-section uncertainty are due to sample properties, beam monitors (used to normalize sample-in and sample-out counts), and ORELA power variations during the run which affect the deadtime correction. Overall uncertainties in the cross section for this measurement are on the order of 2%. The resulting cross sections are compared with the ENDF/B-V file for nickel; many resonances not presently in the file are observed, and energy-scale differences are noted.

9037 (RL—82-112) **Theory of neutron scattering from mixed harmonic solids.** Warner, M.; Lovesey, S.W.; Smith, J. (Science Research Council, Chilton (UK). Rutherford and Appleton Labs.). Dec 1982. 60p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE83704066.

The dynamic structure factor for incoherent neutron scattering from light mass particles substituted in a solid is calculated for two model systems. One model is appropriate for a dilute concentration of light particles in a matrix, and the second is a binary system with various masses and force constants. The exact calculations are used to assess the value of approximation schemes for the dynamic structure factor which exploit the separation of time scales in the motions of the light and the heavier lattice particles.

9038 **Comparison of measured and calculated neutron and gamma ray energy spectra behind an in-line shielded duct.** Santoro, R.T.; Alsmiller, R.G.; Barnes, J.M. Jr.; Chapman, G.T.; Tang, J.S. (Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). *Journal of Fusion Energy;* 2: No. 6, 403-412(Dec 1982). Contract W-7405-ENG-26.

Integral experiments that measure the transport of about 14 MeV neutrons through a 0.30-mdiameter duct having a length-to-diameter ratio of 2.83 that is partially plugged with a 0.15 m diameter, 0.51 m long shield comprised of alternating layers of stainless steel type 304 and borated polyethylene have been carried out at the Oak Ridge National Laboratory. Measured and calculated neutron and gamma ray energy spectra are compared at several locations relative to the mouth of the duct. The measured spectra were obtained using an NE-213 liquid scintillator detector with pulse shape discrimination methods used to simultaneously resolve neutron and gamma ray events. The calculated spectra were obtained using a computer code network that incorporates two radiation transport methods: discrete ordinates (with P_3 multigroup cross sections) and Monte Carlo (with continous point cross sections). The two radiation transport methods are required to account for neutrons that singly scatter from the duct to the detectors. The calculated and measured neutron energy spectra above 850 keV agree within 5-50% depending on detector location and neutron energy. The calculated and measured gamma ray energy spectra above 750 keV are also in favorable agreement, about 5-50%, depending on detector location and gamma ray energy.

9039 **Nuclear shielding calculations for some first-row, second-row and transition metal elements.** Na-Lamphun, B. Guildford, England; Surrey University (1982). 227p. British Library, Boston Spa, Wetherby, West Yorks. No. D43847/82.

The isotropic shielding of some nuclei, other than protons, of first- and second-row atoms in the periodic table and some transition metal elements has been calculated in a wide variety of molecular environments, with a view to gaining an understanding of the various electronic factors which determine the observed nuclear shielding.

6550 Medical Physics

9040 **(CCEMRI—1-1981) Advisory Committee for the Calibration Standards of Ionizing Radiation Measurement. Section 1. X and γ radiations, electrons.** (Bureau International des Poids et Mesures, 92 - Sevres (France)). 1982. 50p. (In French and English). (CONF-8106309—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83704130.

From 6. meeting of the section 1 of the advisory committee for the calibration standards of ionizing radiation measurement; Sevres, France (3 Jun 1981).

Section I (Rayons X et γ, electrons) of the Comite Consultatif pour les Etalons de Mesure des Rayonnements Ionisants held its sixth meeting in June 1981. The work carried out recently in various laboratories represented at the meeting is contained in a series of Progress Reports. Several international comparisons of exposure standards performed at BIPM between 5 keV and 1.2 MeV were presented and the question of exposure measurements at protection-level exposure rates was raised. The work of the three existing Working Parties was discussed at length: comparison of Fricke chemical dosimetry systems, conversion of exposure to absorbed dose in water, conversion of graphite absorbed dose into water absorbed dose. A recommendation was made concerning the possibility of expressing in terms of air kerma or water kerma calibrations made in terms of exposure.

9041 **(CCEMRI—2-1981) Advisory Committee for the Calibration Standards of Ionizing Radiation Measurement. Section 2. Radionucleide Measurement.** (Bureau International des Poids et Mesures, 92 - Sevres (France)). 1982. 36p. (In French and English). (CONF-8105229—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83704132.

From 6. meeting of the section 2 of the advisory committee for the calibration standards of ionizing radiation measurement; Sevres, France (5 May 1981).

Section II (Mesure des radionucleides) of the Comite Consultatif pour les Etalons de Mesure des Rayonnements Ionisants held its sixth meeting in May 1981. The results of an international comparison of ^{55}Fe, organized by the National Physical Laboratory, and of a trial comparison of ^{133}Ba were discussed. A full-scale comparison of ^{137}Cs activity measurements and a repetition of the ^{133}Ba trial comparison are to take place within the next two years. A trial comparison of ^{109}Cd is also proposed. Recent work in radioactivity carried out at BIPM was reported. The usefulness of the international reference system for measuring the activity of gamma-ray emitters was generally acknowledged. The new "selective sampling" method which avoids measuring coincidences attracted much attention. The Working Party reports and a new monograph (BIPM-3) were presented. Finally, there was a broad exchange of information on work in progress at the various laboratories represented at the meeting.

9042 **(CCEMRI—3-1981) Advisory Committee for the Calibration Standards of Ionizing Radiation Measurement: Section 3. Neutron measurements.** (Bureau International des Poids et Mesures, 92 - Sevres (France)). 1982. 38p. (In French and English). (CONF-8105230—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83704133.

From 5. meeting of the section 3 of the advisory committee for the calibration standards of ionizing radiation measurement; Sevres, France (25 May 1981).

Section III (Mesures neutroniques) of the Comite Consultatif pour les Etalons de Mesure des Rayonnements Ionisants held its fifth meeting in May 1981. Recent work carried out at BIPM in the field of neutron measurements was reported. The status of a full-scale ^{252}Cf neutron source intercomparison ($10^7 s^{-1}$) and of several restricted comparisons was discussed. Intercomparisons of fast neutron fluence rates are in progress ($^{115}In(n,n')^{115}Insup(m)$; NB/Zr) or will take place in the near future ($^{115}n(n,\gamma)^{116}Insup(m)$; ^{238}U and ^{235}U fission chambers). An intercomparison of neutron dosimetry standards by circulating tissue-equivalent ion chambers will be prepared and organized by BIPM. Finally, there was a broad exchange of information on work in progress at the various laboratories represented at the meeting.

9043 **(CCEMRI—1981) Advisory Committee for the Calibration Standards of Ionizing Radiation Measurement.** (Bureau International des Poids et Mesures, 92 - Sevres (France)). 1982. 41p. (In French and English). (CONF-8107117—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83704131.

From 9. session of the advisory committee for the calibration standards of ionizing radiation measurement; Sevres, France (27 Jul 1981).

An account of the activity during the past two years and of the plans for future work is given for the three Sections of the Comite Consultatif pour les Etalons de Mesure des Rayonnements Ionisants. Section I (Rayons X et γ, electrons) studied in detail the results of an intercomparison of Frike dosimeters. A recommendation was made concerning the possibility of expressing calibrations made in terms of exposure in terms of air kerma or water kerma. Section II (Mesure des radionucleides) studied the results of recent international comparisons (^{55}Fe, ^{133}Ba and ^{134}Cs) and made plans for new ones. Section III (Mesures neutroniques) presented the status of the international comparisons of neutron fluence rate in progress and decided to organize new ones. The reports of the Section chairmen are followed by the presentation of the work carried out at BIPM by the corresponding groups. The status of the proposal by Section III for a 14 MeV neutron dosimetry facility at BIPM is discussed in detail and a proposal is made for a neutron dosimetry intercomparison.

9044 **(FERMILAB/TM—1145) Scaling neutron absorbed dose distributions from one medium to another.** Awschalom, M.; Rosenberg, I.; Ten Haken, R.K. (Fermi National Accelerator Lab., Batavia, IL (USA)). Nov 1982. Contract AC02-76CH03000. 42p. NTIS, PC A03/MF A01. Order Number DE84004980.

Central axis depth dose (CADD) and off-axis absorbed dose ratio (OAR) measurements were made in water, muscle and whole skeletal bone TE-solutions, mineral oil and glycerin with a clinical neutron therapy beam. These measurements show that, for a given neutron beam quality and field size, there is a universal CADD distribution at infinity if the depth in the phantom is expressed in terms of appropriate scaling lengths. These are essentially the kerma-weighted neutron mean free paths in the media. The method used in ICRU No. 26 to scale the CADD by the ratio of the densities is shown to give incorrect results. the OAR's measured in different media at depths proportional to the respective mean free paths were also found to be independent of the media to a good approximation. It is recommended that relative CADD and OAR measurements be performed in water because of its universality and convenience. A table of calculated scaling lengths is given for various neutron energy spectra and for various tissues and materials of practical importance in neutron dosimetry.

9045 **(ORNL/TM—8698) Nineteenth nuclear accident dosimetry intercomparison study, August 9-13, 1982.** Greene, R.T.; Sims, C.C.; Swaja, R.E. (Oak Ridge National Lab., TN (USA)). Nov 1983. Contract W-7405-ENG-26. 55p. NTIS, PC A04/MF A01. Order Number DE84004595.

The Nineteenth Nuclear Accident Dosimetry Intercomparison Study was held August 9 to 13, 1982, at the Oak Ridge National Laboratory using the Health Physics Research Reactor operated in the pulse mode to simulate nuclear criticality accidents. Participants from eight organizations measured neutron and gamma doses at air stations and on phantoms for three different shielding conditions. Measured results were compared to nuclear industry guidelines for criticality accident dosimeters which suggest accuracies of

+-25% for neutron dose and +-20% for gamma dose. Seventy-two percent of the neutron dose measurements using foil activation, sodium activation, hair sulfur activation, and thermoluminescent methods met the guidelines while less than 40% of the gamma dose measurements were within +-20% of reference values. The softest neutron energy spectrum (also lowest neutron/gamma dose ratio) provided the most difficulty in measuring neutron and gamma doses. Results of this study indicate the need for continued intercomparison and testing of nuclear accident dosimetry systems and for training of evaluating personnel. 14 references, 7 figures, 16 tables.

6560 Solid State Physics

REFER ALSO TO CITATION(S) 7867, 8026

9046 **(CONF-8308125—4) Melting of electrons on corrugated surfaces: structural and dynamical properties in liquid and solid phases.** Vashishta, P.; Kalia, R.K.; Quinn, J.J. (Argonne National Lab., IL (USA); Brown Univ., Providence, RI (USA). Dept. of Physics). Nov 1983. Contract W-31-109-ENG-38. 10p. NTIS, PC A02/MF A01. Order Number DE84004023.

From 3. international conference on recent progress in many-body theories; Altenberg, F.R. Germany (29 Aug 1983).

Properties of a classical system of electrons on smooth and periodically corrugated surfaces are investigated using the molecular dynamics method. In the liquid phase, the electron-electron interaction, the total internal energy, the diffusivities parallel and perpendicular to the corrugation are all periodic functions of the wavevector of the corrugation. Thermodynamic and dynamical properties reveal a first-order melting transition for electrons on a smooth surface. Study of the melting transition on the commensurate corrugated surface of wavevector $\lambda = \sqrt{3}/2$ a (system S_2) shows a tricritical point separating a line of first-order transitions from a line of continuous transitions. On the commensurate corrugation of wavelength $\lambda = \sqrt{3}/4$ a (system S_4) melting transition is always first order. Topological analysis of particle coordinations shows bound dislocation pairs in the electron solid, a large number of defects and grain-boundary loops to be responsible for a first-order transition, and a small density of free dislocations to be the cause of continuous melting transition. 14 references.

9047 **(DOE/ER/05002—37) Structural unit/grain boundary dislocation model for grain boundary structure.** Balluffi, R.W.; Bristowe, P.D. (Massachusetts Inst. of Tech., Cambridge (USA)). Dec 1983. Contract AC02-78ER05002. 35p. NTIS, PC A03/MF A01. Order Number DE84003167.

The applicability of the structural unit/grain boundary dislocation (GBD) model to recently calculated core structures of a number of series of boundaries is considered. The following questions are posed: (1) Is there a best choice of structural units. (2) Can the distortions of these units be understood in a systematic way. (3) Are the distortions of the units of a given type sufficiently small to justify the model. Questions (1) and (2) are discussed in detail and answered affirmatively. The answer to Question (3) is qualified. It is pointed out that relaxations occur in all boundaries tested which tend to improve the uniformity of the units, localize the corresponding GBDs and, hence, increase the applicability of the model. The model therefore stands as the most physically viable model for representing the systematics of the computed core structures. However, in some cases, these relaxations are relatively weak, the units exhibit significant systematic distortions, and the corresponding GBDs are partially delocalized. In such cases the model must be considered an approximation, particularly for many quantitative purposes.

9048 **(DOE/ER/10866—T2) Oscillatory length dependent conductivity in periodic and almost periodic crystals.** Sokoloff, J.B. (Northeastern Univ., Boston, MA (USA). Dept. of Physics). Jun 1983. Contract AC02-81ER10866. 17p. NTIS, PC A02/MF A01. Order Number DE84004364.

Large oscillations as a function of system length are found numerically in the transmissions coefficient and hence, conductivity of a finite almost periodic system for a particular value of the energy and potential strength. This behavior is reminiscent of that which is shown to occur for any periodic system of finite length near a band edge.

9049 **(INIS-mf—8664) 1982 Annual convention of the Austrian Physical Society, University of Graz, 22 - 24 September 1982.** (Oesterreichische Physikalische Gesellschaft, Vienna). 1982. 90p. (In German). (CONF-8209185—). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84700203.

From Annual conference of the Austrian Physical Society; Graz, Austria (22 Sep 1982).

Proceedings of lectures and poster presentations given at the 1982 convention of the Austrian Physical Society, with (German) abstracts only. The three topical sessions were: 1) solid state physics 2) physics of high polymers 3) nuclear and particle physics Only part of the presentations pertain to the subject matter of INIS.

9050 **(INIS-mf—8664, pp 34) Momentum distribution of positron-electron pairs in metals.** Sormann, H.; Kindl, P.; Puff, W. (Technische Univ., Graz (Austria). Inst. fuer Kernphysik). 1982. (In German). NTIS (US Sales Only), PC A05/MF A01. (CONF-8209185—).

From Annual conference of the Austrian Physical Society; Graz, Austria (22 Sep 1982).

Published in summary form only.

9051 **Effects of triaxial stressing on creep cavitation of grain boundaries.** Sham, T.L.; Needleman, A. (Division of Engineering, Brown University, Providence, RI 02912). *Acta Metallurgica;* **31**: No. 6, 919-926(Jan 1983). Contract AC02-80ER10556.

The authors investigate the influence of triaxial stressing on the growth of cavities on grain boundaries by the combined processes of plastic creep flow and grain boundary diffusion. The coupling arises from local accommodation of matter on the grain boundary near the cavity tip due to plastic creep deformability of the grains. This has the effect of shortening the diffusion path length on the grain boundary and increasing the cavity volumetric growth rate. An increase in triaxiality is found to accelerate the matter flux flowing from the cavity surfaces onto the grain boundaries and thus increase the cavity volumetric growth rate. This occurs at attainable levels of triaxiality. However, the enhancement in the triaxial stress state does not affect the effective diffusion path length very significantly. A simple formula for the volumetric growth rate of the cavity is suggested and it is found to give a good approximation to the numerically computed results.

6561 Superconductivity

REFER ALSO TO CITATION(S) 7884, 7971, 7976, 7977

6570 Theoretical Physics

REFER ALSO TO CITATION(S) 8266, 8268, 8751

9052 **(AD-A—131525/8) Alternative approach to quantum statistics.** Teilter, S.; Jajopal, A.K. (Louisiana State Univ., Baton Rouge (USA). Dept. of Physics and Astronomy). 21 Jun 1983. 15p. NTIS, PC A02/MF A01.

The Fermi-Dirac, Bose-Einstein and, for completeness the Maxwell-Boltzmann, distributions are obtained respectively from considerations of binomial, negative binomial, and Poisson assemblies. The method used has the simplicity of the traditional derivations that are based on combinatorial considerations but involves neither the identification of most probable values with means values nor the invocation of large numbers of particles involved in the use of Stirling's approximation for factorials. The method thereby also relaxes the requirement for large numbers of particles needed in other available derivations that also use mean values, namely, the Darwin-Fowler method of steepest descents and the Khinchin method that employs limit theorems of the theory of probability.

9053 **(CEA-N—2317) Calculation of electrostatic fields by a FREDHOLM like method.** El Minyawi, Nagda. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Nov 1982. 30p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83704193.

In some special studies (e.g. accelerators, plasmas, etc..), it is necessary to calculate potentials or fields from known charge distributions. In this study, attention is drawn to the following case: mobile charges distributed arbitrarily in a volume almost entirely enclosed by metallic walls consisting of cylindrical cavities connected to one another by cylindrical tubes separated by fixed intervals. These charges induce surface charges on the conducting walls. The surface charges, themselves, induce an electric field, which interacts with the motion of the mobile charges. In order to simplify the studies, special consideration is given to the case of a single fixed charge and a single cylinder and then to a single cavity. A integral equation system is obtained. A FREDHOLM like method is used to solve this system.

9054 **(IN2P3—81-1) Perturbative QCD and high energy physics (Gif-81).** Aubert, J.J.; Bassetto, A.; Boucrot, J.; Fontannaz, M.; Fournier, D.; Furmanski, W.; Le Bellac, M. (Institut National de Physique Nucleaire et de Physique des Particules, 75 - Paris (France)). 1983. 297p. (In French, English). (CONF-8109247—). NTIS (US Sales Only), PC A13/MF A01. Order Number DE84750206.

From Summer school on particle physics; Gif-sur-Yvette, France (7 Sep 1981).

Portions are illegible in microfiche products.

This book contains 7 lectures presented at the Summer school in Gif-sur-Yvette on the state at the present day of the quantum chromodynamics, the experimental difficulties and the tests. Separate abstracts were prepared for the individual papers.

9055 (IN2P3—81-1, pp 1-21) **Introduction to the topics of the 1981 Gif-sur-Yvette summer school.** Fontannaz, M. 1983. (In French). NTIS (US Sales Only), PC A13/MF A01. (CONF-8109247—).

From Summer school on particle physics; Gif-sur-Yvette, France (7 Sep 1981).

Portions are illegible in microfiche products.

This general introduction begins by a review of the parton model and some remarks on perturbative Q.C.D. The technical and physical problems encountered when perturbative Q.C.D. is applied to high-energy reactions are briefly discussed by means of a simple example.

9056 (IN2P3—81-1, pp 22-119) **Perturbative quantum chromodynamics in leading log approximation and perturbative corrections to the Drell-Yan process.** Le Bellac, M.. 1983. (In French). NTIS (US Sales Only), PC A13/MF A01. (CONF-8109247—).

From Summer school on particle physics; Gif-sur-Yvette, France (7 Sep 1981).

Portions are illegible in microfiche products.

After reviewing the main results on deep inelastic scattering using light-cone expansion and Wilson expansion, I describe the diagrammatic approach to the proof of these results, in particular in the form of the Altarelli-Parisi equations. The calculation of terms of order g^2, with and without leading-log approximation, is exhibited in detail, and generalized to all orders: ladder diagrams and renormalization. As an application, the structure function of the photon is computed. Corrections of order αsub(s) to the Drell-Yan process are computed to illustrate the mass-singularity factorization theorem. Also discussed are the exponentiation of the infrared part of this correction and the phenomenological applications.

9057 (IN2P3—81-1, pp 120-144) **Scaling violation effects in QCD beyond leading log approximation.** Furmanski, W. 1983. NTIS (US Sales Only), PC A13/MF A01. (CONF-8109247—).

From Summer school on particle physics; Gif-sur-Yvette, France (7 Sep 1981).

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A systematic method of analyzing the scaling violation effects in hard processes in QCD has been presented in the framework of mass factorization technique in the light-like gauge. The method was illustrated on the example of deep inelastic scattering. The factorization of mass singularities has been performed by using the generalized ladder expansion for the full modulus squared of the photon-hadron amplitude. The Q^2 dependence of parton densities was derived by using the renormalization group methods. It has been shown that the Parisi-Altelli equation remains valid to any order in α after replacing the Parisi-Alterelli probabilities by "generalized probabilities", given by power series in α. The generalized probabilities satisfy the parton model sum rules like fermion number conservation or momentum conservation. Typical ambiguities in the higher order formulae like renormalization scheme dependence, factorization scheme dependence or renormalisation scale (μ^2) dependence, have been discussed on the example of deep inelastic scattering. The method has been then extended to any other hard process. As an example of application, the short distance cross-section for large Psub(t) scattering has been derived. It turns out that the large $O(\alpha)$ corrections for this process can be almost entirely removed by appropriate choice of the renormalization scale. Finally the method has been extended on the higher twist sector.

9058 (IN2P3—81-1, pp 145-179) **"Double logs" resummations in perturbative Q.C.D.** Bassetto, A. 1983. NTIS (US Sales Only), PC A13/MF A01. (CONF-8109247—).

From Summer school on particle physics; Gif-sur-Yvette, France (7 Sep 1981).

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We examine processes which are sensitive to the infrared structure of Q.C.D. Consequences are derived for structure and fragmentation functions at x near 1, large angle correlations, Drell-Yan corrections and for the average parton multiplicity. Finally we discuss the color structure of the theory and the appearance of color singlets with bounded average mass in the "final " states.

9059 (IN2P3—81-1, pp 209-226) **Some experimental tests of perturbative Q.C.D. predictions in hadronic production of lepton pairs.** Boucrot, J. 1983. (In French). NTIS (US Sales Only), PC A13/MF A01. (CONF-8109247—).

From Summer school on particle physics; Gif-sur-Yvette, France (7 Sep 1981).

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Hadronic production of massive lepton pairs by Drell-Yan is an experimental test ground of perturbative Q.C.D. predictions. The total cross section is found experimentally to be K approximately 2.5 times higher than predicted by the parton model; this K factor is successfully explained by next-to leading calculations in Q.C.D. In the case of transverse momentum distributions the situation is more complicated; the experimental results seem to be satisfactorily explained by double logarithm resummations in Q.C.D..

9060 (INIS-mf—8307, pp 91-92) **Monte Carlo evaluation of fermionic functional integrals using real coherent states of Slater determinants.** Avishai, Y. (Ben-Gurion Univ. of the Negev, Beersheba (Israel). Dept. of Physics); Richert, J. (Strasbourg-1 Univ., 67 (France). Lab. de Physique Nucleaire Theorique). 1983. NTIS (US Sales Only), PC A11/MF A01. (CONF-830118—).

From 11. international workshop on gross properties of nuclei and nuclear excitations; Hirschegg, Austria (17 Jan 1983).

In this work we study the application of Monte Carlo Methods for the evaluation of (imaginary time) functional integrals in the space of real coherent states of Slater determinants.

9061 **(TRI-PP—83-101) Gradient expansions and quantum mechanical extensions of the classical phase space.** Jennings, B.K. (British Columbia Univ., Vancouver (Canada). TRIUMF Facility). Sep 1983. 3p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84900513.

One common feature of most derivations of the gradient expansion for the kinetic energy density is the use of a mock phase space in intermediate steps. By mock phase space I mean a space parametrized by two coordinates p and r which in the classical limit reduce to the classical phase space. Of cource a real phase space can not be defined quantum mechanically since p and r can not be specified simultaneouly. Also there are many different mock phase spaces of which two in particular are frequently used. We will discuss these two in detail later. Icc will begin by giving a

brief derivation of the Thomas-Fermi relation between the kinetic energy density and the spatial density to motivate the use of phase space and then indicate how this must be generalized. I then will discuss the various quantum mechanical generalizations of the phase space and show using the Wigner transform as an example one method of obtaining an h expansion.

9062 **Enskog theory for multicomponent mixtures. III. Transport properties of dense binary mixtures with one tracer component.** Lopez de Haro, M.; Cohen, E.G.D. (The Rockefeller University, New York, New York 10021). *Journal of Chemical Physics;* 80: No. 1, 408-415(1 Jan 1984).

The transport properties of dense binary fluid mixtures with one tracer component are discussed in the context of the revised Enskog theory (RET). Except for the mutual and thermal diffusion coefficients, the transport coefficients are those of the excess component alone. The kinetic diffusion coefficient is given exactly by its low density (Boltzmann) value divided by the magnitude of the radial distribution function at contact. The values of the mutual and thermal diffusion coefficients can be estimated to within 1% for all mass ratios μ. A comparison with earlier work on the limiting cases of the Rayleigh ($\mu = \infty$) and Lorentz ($\mu = 0$) gases is made.

9063 **Influence of gap length on the field increase factor β of an electrode projection (whisker).** Miller, H.C. (General Electric Company, Neutron Devices Department, St. Petersburg, Florida 33733). *Journal of Applied Physics;* 55: No. 1, 158-161(1 Jan 1984). Contract AC04-76DP00656.

β, the increase of the macroscopic electric field at the tip of a projection, varies with the gap length. The sign and magnitude of this variation depends upon how the gap length is defined. If gap length is defined as x, the distance from the projection tip to the opposing electrode, then β is a strong function of x and may be approximated by β(x) = β/sub infinity/x/(x+h) [h = projection height] in the region where x/h>10/β/sub infinity/. If gap length is defined as d, the interelectrode distance ignoring the projection, then β is a weak function of d and may be set equal to β/sub infinity/ in the region d/h>2.

9064 **Many-body forces in directly interacting systems.** Biswas, T.; Rohrlich, F. (Syracuse Univ., NY (USA). Dept. of Physics); King, M. (Argonne National Lab., IL (USA)). *Nuovo Cimento della Societa Italiana di Fisica [Sezione] B;* 77: No. 1, 49-61(11 Sep 1983).

The conventional formulation of classical relativistic Hamiltonian constraint dynamics of N interacting particles assumes N constraints which are required to satisfy an Abelian Poisson-bracket algebra. This requirement imposes restrictions on the permitted interactions, resulting in many-body forces. These are difficult to compute for given two-body forces. We propose a perturbative method for this purpose, which is symmetric in the particles. It requires Poincare-invariant integration, which is discussed in detail. An example is solved explicitly.

9065 **Numerical calculations of ultrasonic fields I: transducer near fields.** Johnson, J.A. (EG & G Idaho, Idaho Falls, Idaho 83415). *Journal of Nondestructive Evaluation;* 3: No. 1, 25-35(Mar 1982). Contract AC07-76ID01570.

A computer code for the calculation of linear acoustic wave propagation in homogeneous fluid and solid materials has been derived from the thermal-hydraulics code STEALTH. The code uses finite-difference techniques in a two-dimensional mesh made up of arbitrarily shaped quadrilaterals. Problems with two-dimensional plane strain or two-dimensional axial symmetries can be solved. Free, fixed, or stressed boundaries can be used. Transducers can be modeled by time dependent boundary conditions or by moving pistons. This paper gives a brief description of the method and shows the results of the calculation of the near fields of circular flat and focused transducers. These results agree with analytic theory along the axis of symmetry and with other codes that use a Huygens reconstruction technique off-axis.

9066 **Spherical wave decompostion approach to ultrasonic field calculations.** Griffice, C.P.; Seydel, J.A. (Sidney-Farber Cancer Inst., Boston, Massachusettes). *Journal of Nondestructive Evaluation;* 2: No. 3/4, 241-247(Dec 1981). Contract AC07-76ID01570.

A simple, flexible, accurate, and comprehensive numerical method is presented for theoretically analyzing the diffraction field of a continuous wave transducer of arbitrary size, shape, and frequency. Using the extensively studied circular transducer for comparison, numerical results are shown for an unfocused transducer with uniform velocity excitation as well as for a focused transducer with Gaussian velocity excitation. Data concerning the execution time, program size, and convergence of the method are also presented for its implementation as a design tool on a minicomputer system.

6580 Mathematical Physics

REFER ALSO TO CITATION(S) 9061

9067 **(CONF-8310226—1) Quantum mechanical Hamiltonian models of the computation process.** Benioff, P. (Argonne National Lab., IL (USA)). 1983. Contract W-31-109-ENG-38. 5p. NTIS, PC A02/MF A01. Order Number DE84003996.

From National Science Foundation conference on chemically based computer designs; Los Angeles, CA, USA (24 Oct 1983).

As noted in the proceedings of this conference it is of importance to determine if quantum mechanics imposes fundamental limits on the computation process. Some aspects of this problem have been examined by the development of different types of quantum mechanical Hamiltonian models of Turing machines. (Benioff 1980, 1982a, 1982b, 1982c). Turing machines were considered because they provide a standard representation of all digital computers. Thus, showing the existence of quantum mechanical models of all Turing machines is equivalent to showing the existence of quantum mechanical models of all digital computers. The types of models considered all had different properties. Some were constructed on two-dimensional lattices of quantum spin systems of spin 1/2 (Benioff 1982b, 1982c) or higher spins (Benioff 1980). All the models considered Turing machine computations which were made reversible by addition of a history tape. Quantum mechanical models of Bennett's reversible machines (Bennett 1973) in which the model makes a copy of the computation result and then erases the history and undoes the computation in lockstep to recover the input were also developed (Benioff 1982a). To avoid technical complications all the types of models were restricted to modelling an arbitrary but finite number of computation steps.

9068 **(DOE/ER/10353—5) Computational methods for the nuclear and neutron matter problems. Progress report.** Kalos, M.H. (New York Univ., NY (USA). Courant Inst. of Mathematical Sciences). 1983. Contract AC02-79ER10353. 15p. NTIS, PC A02/MF A01. Order Number DE84004214.

Studies include mirror potentials and the many-fermion problem and variational Monte Carlo calculation of quark matter. Progress is described, and publications are listed. (WHK)

9069 **(DOE/ER/10711—2) Applied mathematics of transport theory. Progress report, September 1982-November 1983.** Greenberg, W.; Zweifel, P.F. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA)). 1983. Contract AS05-80ER10711. 18p. NTIS, PC A02/MF A01. Order Number DE84004135.

Progress in several continuing areas of mathematics research is outlined under the following general subheadings: (A) Abstract Transport Theory; (B) Explicit Models and Numerical/Computational Analysis; (C) Gas Dynamics; and (D) Miscellaneous. New results obtained in the above research areas have been reported on in a number of journal articles and in national and international technical conferences. A detailed bibliography follows this text.

9070 **(UCRL—15572) Moving finite elements in 1-D: a review of the method and the coding experience.** Sincovec, R.; Aslam, S. (Colorado Univ., Colorado Springs (USA). Dept. of Computer Science). Sep 1983. Contract W-7405-ENG-48. 134p. NTIS, PC A07/MF A01. Order Number DE84004821.

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We developed the code which can solve a system of nonlinear partial differential equations using the moving finite element (MFE) method. We have demonstrated its capabilities by presenting solutions for Burger's equation, reactive and non-reactive square waves, and as required by the contract, Maxwell's equations. We have certainly realized the elegance in the idea and mathematics involved with the MFE method; we are very apprehensive of using the code. Compared to conventional numerical packages, some of which allow the user almost hands off computing, the MFE code places a large burden on the user. We have not been able to come up with a suitable way for selecting the number nodes to use and how to place them initialy. Choosing the optimum values for constants in the regularization term is pure guess work (or so it seems). This combined with the selection of error tolerances for the ODE integrator, and selecting suitable weights for the PDE's makes one very skeptic of obtaining results within a suitable amount of time and effort. When one guesses the parameters right, the results obtained are indeed remarkable. If all the given work could some how be avoided, we strongly feel that the MFE method would be a very powerful tool.

6590 Communication, Education, History, And Philosophy

9071 (INIS-BR—78) Proceedings of the 7. Annual Congress of the Brazilian Biophysics Society. (Sociedade Brasileira de Biofisica, Rio de Janeiro). 1982. 130p. (In Portuguese). (CONF-821254—Summ.). NTIS (US Sales Only), PC A07/MF A01. Order Number DE83703947.

From 7. annual congress of the Brazilian Biophysics Society; Rio de Janeiro, Brazil (15 Dec 1982).

Papers on biophysics, radioecology and photochemistry are presented, aiming to inform what is being done in Brazil in those areas.

70 FUSION ENERGY

7001 Plasma Research

REFER ALSO TO CITATION(S) 8044, 9178

9072 (AD-A—131478/0) Unified theory of plasma correlations. Interim report. Guillen, M.A.; Liboff, R.L. (Cornell Univ., Ithaca, NY (USA)). 13 Jun 1983. 35p. NTIS, PC A03/MF A01.

A unified approach to the theory of correlations in a plasma is presented, based on the BBKGY hierarchy. The theory is applied to a one-component plasma with the Coulomb interaction modified to include effects of the background. Closed integro-differential equations in space and time are obtained for the two-particle correlation function in both the strong and weak coupling limits. In the weak-coupling domain, gamma $<<1$, the time-independent analysis returns the well-known linearized Debye-Huckle result, where gamma is the plasma parameter. In the strong-coupling domain gamma >1, the resulting two-particle total correlation function exhibits decaying oscillatory behavior for particle separation of the order of the effective interparticle range.

9073 (AD-A—131600/9) Solutions of a fourth order differential equation describing mode conversion in a magnetized plasma. Maggs, J.E.; Banos, A. Jr.; Morales, G.J. (California Univ., Los Angeles (USA). Center for Plasma Physics and Fusion Engineering). Jun 1983. 64p. (PPG—722). NTIS, PC A04/MF A01.

This paper investigates the solutions of a fourth order differential equation which arises in the description of high frequency electrostatic waves near plasma resonance in a magnetized plasma with a zero order density gradient along the magnetic field. The behavior of the electrostatic potential is described by Poisson's equation.

9074 (CONF-830908—7) Neutral injection experiments on the ISX-B tokamak. Scott, S.D. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 24p. NTIS, PC A02/MF A01. Order Number DE84003312.

From 11. European conference on controlled fusion and plasma physics; Aachen, F.R. Germany (5 Sep 1983).

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The following topics are described: (1) review of confinement scaling in ISX-B with strong neutral injection in clean plasmas, (2) discussion of observed energy confinement improvement in slightly contaminated discharges (factor ≤ 2), and (3) preliminary evaluation of confinement with balanced neutral beam injection. (MOW)

9075 (CONF-831203—66) Tokamak plasma position dynamics and feedback control. Burenko, L.; Bailey, J.M. (Oak Ridge National Lab., TN (USA); Tennessee Univ., Knoxville (USA). Dept. of Electrical Engineering). 1983. Contract W-7405-ENG-26. 6p. NTIS, PC A02/MF A01. Order Number DE84004424.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

The perturbation equations of a tokamak plasma equilibrium position are developed. Solution of the approximated perturbation equations is carried out. A unique, simple, and useful plasma displacement dynamics transfer function of a tokamak is developed. The dominant time constants of the dynamics transfer function are determined in a symbolic form.

9076 (DOE/ER/51035—T1) Elmo Bumpy Torus physics. Interim technical report, May 24, 1983-October 1, 1983. Bieniosek, F.M.; Kashuba, R.J. (McDonnell Douglas Astronautics Co., St. Louis, MO (USA)). 1983. Contract AC05-83ER51035. 44p. NTIS, PC A03/MF A01. Order Number DE84004929.

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This progress report covers the technical work performed during the initial funding period of the contract, May 24-October 1, 1983. The contract presently includes work on three tasks: T-M Transition studies on EBT-S, pulsed high density experiments on EBT-S, and theoretical studies of ion rings in EBT. The work on Task 2 consisted of developing a preliminary plan for the pulsed experiments and some exploratory experimental runs on EBT-S. Within the Task 3 effort considerable work was accomplished on ion ring formation. This work was able to benefit from previous research and code development done at MDAC. This report also covers preliminary results on investigation of stabilization of ballooning and interchange modes by high energy rings. This investigation is particularly important for ion rings because, should stabilization properties depend on ion energy in the rings, the required ion energies could be important in power balance considerations.

9077 (DOE/ER/53121—T1) Theoretical studies of the heating of toroidal plasmas with radio frequency electromagnetic radiation. Final report. Glasser, A.H.; Swanson, D.G.; Wersinger, J.M. (Auburn Univ., AL (USA)). 12 Feb 1982. Contract AC01-81ER53121. 30p. NTIS, PC A03/MF A01. Order Number DE84004609.

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The continuation of a program of theoretical studies of the heating of toroidal plasmas with radio frequency (RF) electromagnetic radiation is proposed. Funding for this project first began on September 3, 1981, and will expire on April 2, 1982. A summary of the principal accomplishments of the first five months of the project is presented. These include the acquisition of computer terminals and modems, the implementation of existing codes on the MFECC C Cray Computer, the extension of the LHTOR lower hybrid toroidal ray tracing code to the full electromagnetic dispersion relation, the implementation of graphic output from the code, the beginning of extensive parameter studies, the beginning of an analytical treatment of the mode conversion layer associated with singular harmonic absorption, and the introduction of a graduate student into the program.

9078 (DOE/ET/51013—96) One-dimensional fluid model for transport in divertor and limiter tokamak scrape-off layers. Lipschultz, B. (Massachusetts Inst. of Tech., Cambridge (USA). Plasma Fusion Center). Nov 1983. Contract AC02-78ET51013. 15p. (PFC/RR—83-25). NTIS PC A02/MF A01. Order Number DE84004649.

Single-fluid transport in the plasma scrape-off layer is modeled for poloidal divertor and mechanically limited discharges. This numerical model is one-dimensional along a field line and time-independent. Conductive and convective transport, as well as impurity and neutral source (sink) terms are included. A simple shooting method technique is used for obtaining solutions. Results are shown for the case of the proposed Alcator DCT tokamak.

9079 (DOE/ET/51013—101) **Comparison between the radial density buildup in the TARA plugs using hydrogen versus deuterium neutral beams.** Blackfield, D.T. (Massachusetts Inst. of Tech., Cambridge (USA). Plasma Fusion Center). Nov 1983. Contract AC02-78ET51013. 59p. (PFC/RR—83-31). NTIS, PC A04/MF A01. Order Number DE84004598.

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The WOLF code is used to compare the beam divergences from a TARA source using hydrogen and deuterium. Factors which influence the divergence which are investigated are the electron temperature, initial ion energy, electrode positions and ion beam current density. The beam divergence for 20 keV hydrogen is found to be only 20% smaller than for 25 keV deuterium for the same electrode positions. Since the optimal positioning of the electrodes is found to be independent of mesh spacing, a large parameter study is undertaken using little computer time. A time-dependent radial Fokker-Planck code is next used to examine the radial density buildup in a plug of the TARA tandem mirror. For both hydrogen and deuterium neutral beams, the influences of beam positioning, current and energy, edge neutral pressure and assumed electron temperature are studied.

9080 (DOE/ET/52040—296) **Stable Alfven wave dynamo action in the reversed field pinch.** Werley, K.A. (Illinois Univ., Urbana (USA)). 1984. Contract AC02-76ET52040. 161p. (COO—2218-296). NTIS, PC A08/MF A01. Order Number DE84004986.

Portions are illegible in microfiche products; Thesis.

Recent advances in linear resistive MHD stability analysis are used to calculate the quasi-linear dynamo mean electromotive force of Alfven waves. This emf is incorporated into a one-dimensional transport and mean-field evolution code. The changing equilibrium is then fed back to the stability code to complete a computational framework that self-consistently evaluates a dynamic plasma dynamo. Static quasi-linear Alfven wave calculations have shown that dynamo emfs on the order of eta vector J are possible. This suggested a possible explanation of RFP behavior and a new (externally driven) mechanism for extending operation and controlling field profiles (possibly reducing plasma transport). This thesis demonstrates that the dynamo emf can quickly induce plasma currents whose emf cancels the dynamo effect. This thesis also contains extensive studies of resistive Alfven wave properties. This includes behavior versus spectral location, magnetic Reynolds number and wave number.

9081 (DOE/ET/53004—61) **Advanced development of particle beam probe diagnostic systems. Technical progress report, June 1, 1982-October 31, 1983.** Hickok, R.L.; Jennings, W.C.; Connor, K.A. (Rensselaer Polytechnic Inst., Troy, NY (USA)). Nov 1983. Contract AC02-76ET53004. 55p. NTIS, PC A04/MF A01. Order Number DE84003181.

The primary objective of this program is the advanced development of sophisticated particle beam diagnostic techniques for making space and time resolved measurements on high temperature magnetically confined plasmas. The procedure is to develop and test new techniques on small-scale laboratory experiments and then transfer the technology to mainline confinement experiments. During the period covered by this progress report the major advances were: (1) demonstrated that beam probing can provide simultaneous measurements of n, phi and T/sub e/ on plasmas when T/sub e/ is less than approximately 500 eV; (2) demonstrated simultaneous measurements of n tilde and phi tilde on tokamak geometry for frequencies below 200 kHz; (3) developed the concept of multi-element energy analyzer to provide simultaneous measurements for more than one spatial location in the plasma; and (4) carried out preliminary analysis that showed that beam probes can be implemented on complex magnetic geometries such as ATF and that beam probe system could be extended into the MeV energy range.

9082 (DOE/ET/53088—119) **Particle simulation of drift waves in a sheared magnetic field.** Sydora, R.D.; Leboeuf, J.N.; Tajima, T. (Texas Univ., Austin (USA). Inst. for Fusion Studies). Nov 1983. Contract FG05-80ET53088. 54p. NTIS, PC A04/MF A01. Order Number DE84004026.

Electrostatic properties of density gradient drift waves (the universal mode), in a sheared magnetic field, are studied using a two-and-one-half dimensional particle code. For the case of a single rational surface, the drift waves are found to be stable with an eigenmode structure that matches the linear theoretical prediction as long as the ion resonance point is well within the system. This applies to both even and odd parity modes with respect to the rational surface. The dependence on various parameters such as the shear length is examined.

9083 (INIS-mf—8299, pp 181) **Non-linear Landau damping of Alfven waves in a high β plasma.** Cesarsky, C.J. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)); Voelk, H.J. 1983. (In German). NTIS (US Sales Only), PC A11/MF A01.

In Max-Planck-Institut fuer Kernphysik: Annual report 1982.

Nonlinear Landau damping of Alfven waves saturates due to particle trapping in the beat waves. For large wave amplitudes, this trapping effect has the consequence that a wave is damped primarily by waves of comparable wave length.

9084 (INIS-mf—8664, pp 35) **Neutron-free nuclear energy: a neutronic fusion.** Heindler, M.; Niederl, K.; Moser, E.; Papousek, W.; Vones, G.; Zloebl, H. (Technische Univ., Graz (Austria). Inst. fuer Theoretische Physik und Reaktorphysik). 1982. (In German). NTIS (US Sales Only), PC A05/MF A01. (CONF-8209185—).

From Annual conference of the Austrian Physical Society; Graz, Austria (22 Sep 1982).

Published in summary form only.

9085 (ORNL—5919, pp 97-154) **Plasma theory.** Nov 1983. NTIS, PC A15/MF A01.

In Fusion Energy Division annual progress report, period ending December 31, 1982.

The past year's work is discussed in detail for the EBT, tokamak, stellarator, and computing support areas, respectively.

9086 (ORNL—5919, pp 155-170) **Plasma-materials interactions.** Nov 1983. NTIS, PC A15/MF A01.

In Fusion Energy Division annual progress report, period ending December 31, 1982.

During 1982, the program emphasized impurity control and wall conditioning experiments, particle flux and recycling measurements in the plasma edge, and the development of an advanced laser-induced fluorescence diagnostic. A database was established for impurity control by chromium gettering, which indicates impurity pumping without bulk incorporation of hydrogen isotopes in the getter. Wall conditioning studies were initiated on TEXTOR and demonstrated rapid cleanup at high wall temperature. Aperture transmission experiments provided the first information on deuterium fluxes and energies in the plasma edge of EBT-S. The laser-induced fluorescence system was upgraded and preliminary results were obtained for neutral iron in the ISX-B. Other areas of emphasis included participation in pumped limiter studies and laboratory experiments on hydrogen recycling and sputtering.

9087 (ORNL—5919, pp 83-96) **Atomic physics and plasma diagnostics development.** Nov 1981. NTIS, PC A15/MF A01.

In Fusion Energy Division annual progress report, period ending December 31, 1982.

The atomic physics studies encompass three types of activities - experimental collisions studies, theoretical predictions of basic processes, and data center compilations of atomic collision cross sections of interest in fusion. All of these atomic physics endeavors currently concentrate on basic collision processes involving fusion

impurity ions, such as electron capture by impurities from atomic and molecular hydrogen and inelastic collisions of electrons and impurity ions. The experimental and theoretical studies focus on common collision systems in order to develop insights allowing prediction of the broad range of data needed in fusion studies and to provide tests of the reliability of basic data in use. For electron capture, total cross sections are reasonably well characterized for collision energies near and above the orbital velocity of the bound electrons undergoing capture but are not reliably predicted for lower velocities. Neutral beam injection velocities are near or above these orbital velocities, but collisions at plasma thermal energies, especially near the plasma edge, are at the lower velocities that we are studying. Current experimental studies with partially stripped Fe/sup q+/ ions colliding with hydrogen show that capture cross sections follow scaling rules at low velocity, but such simple scaling has not always proved valid for other ions.

9088 (UCID—17530-Rev.3) Computational physics program of the National MFE Computer Center. Revision 3. Mirin, A.A. (Lawrence Livermore National Lab., CA (USA)). Nov 1983. Contract W-7405-ENG-48. 39p. NTIS, PC A03/MF A01. Order Number DE84004602.

The computational physics group is involved in several areas of fusion research. One main area is the application of multidimensional Fokker-Planck, transport and combined Fokker-Planck/transport codes to both toroidal and mirror devices. Another major area is the investigation of linear and nonlinear resistive magnetohydrodynamics in two and three dimensions, with applications to all types of fusion devices. The MHD work is often coupled with the task of numerically generating equilibria which model experimental devices. In addition to these computational physics studies, investigations of more efficient numerical algorithms are being carried out.

9089 Polarized radial magnetic fields and outward plasma fluxes during shallow-reversal discharges in the ZT-40M reversed-field pinch. Jacobson, A.R.; Rusbridge, M.G.; Burkhardt, L.C. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Journal of Applied Physics;* **55**: No. 1, 125-137(1 Jan 1984).

The characteristics of edge-region electromagnetic disturbances and of pulsed radial fluxes of plasma to the liner as well as the detailed interrelationship among these processes have been studied on the ZT-40M reversed-field pinch in its normal, shallow-reversal operating regime. The dominant magnetic disturbances are spiky (pulsewidth ~5—10 μs) low-amplitude ('B/sub r//B/sub theta/' < or ≈10^{-2})= poloidally symmetric radial-field structures intersecting the vacuum wall and precessing toroidally in the anti-I/sub phi/ sense. The effect of even slight toroidal-field reversal ('B/sub phi/(a)'roughly-equalB/sub theta/(a)/10) is to polarize these radial-field spikes preferentially positive (i.e., B/sub r/>0) and to increase the speed of the minority (B/sub r/<0) while decreasing the speed of the majority (B/sub r/>0) spikes. Synchronous with the polarized B/sub r/ spikes are intense radially outward fluxes of plasma (instantaneously > or ≈10^{22} m^{-2} s^{-1}) leading to recurrent, large amplitude ('Δn/n> or ≈25%) depletion of the density in the outer quarter of minor radius. The resulting time-averaged global loss-rate per particle is significant (~10^3 s^{-1}).

9090 Experimental and computational study of high-beta tokamak equilibria. Levinton, F.M.; Grossman, A.A.; Navratil, G.A. (Plasma Physics Laboratory, Columbia University, New York, New York 10027). *Physics of Fluids;* **27**: No. 1, 10-12(Jan 1984). Contract AC02-76ET53016.

High-beta tokamak equilibria in Torus II are studied both experimentally and computationally. Electron temperature and density profile measurements from the multipoint Thomson scattering system and line-integrated density from a CO_2 interferometer show that an equilibrium is obtained with a volume averaged beta of 10%. The peak electron temperature is 80 eV and the density is 1 x 10^{15} cm^{-3}. A numerical computation of these equilibria is carried out using a 2-D, free-boundary, magnetohydrodynamic equilibrium code which is in good agreement with the experimental results.

9091 Ohmic heating of a spheromak to 100 eV. Jarboe, T.R.; Barnes, C.W.; Henins, I.; Hoida, H.W.; Knox, S.O.; Linford, R.K.; Sherwood, A.R. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physics of Fluids;* **27**: No. 1, 13-15(Jan 1984).

The first spheromaks with Thomson-scattering-measured electron temperatures of over 100 eV are described. The spheromak is generated by a magnetized coaxial plasma source in a background gas of 30 mTorr of H_2, and it is stably confined in an oblate 80 cm diam copper mesh flux conserver. The open mesh design allows rapid impurity transport out of the spheromak. The peak temperature, measured using multipoint Thomson scattering, is observed to rise from approximately 25 eV to over 100 eV in about 0.2 msec due to Ohmic heating from the decaying magnetic fields. Density (~5 x 10^{13} cm^{-3}) and magnetic fields (approximately 2 kG) are measured using interferometry and magnetic probes.

9092 Improvement in electrostatic confinement by second-harmonic electron cyclotron heating in the Phaedrus tandem mirror. Sing, D.; Golovato, S.N.; Hershkowitz, N.; Scharer, J. (University of Wisconsin, Madison, Wisconsin 53706). *Physics of Fluids;* **27**: No. 1, 16-18(Jan 1984). Contract AC02-78ET51015.

One minimum-B mirror end cell of the Phaedrus tandem mirror was heated with up to 30 kW of electron cyclotron heating at ω = 2ω/sub c/e. The plug electron temperature was increased from 18 to 23 eV while a smaller temperature increase was measured in the central cell. Changes in ion end loss energy and current were consistent with direct measurements of increases in the east plug plasma potential. Ion confining potential increases of up to 27 V were observed. These increases were much greater than the T/sub e//e increases and in excess of that predicted by the Boltzmann relation.

9093 Reconnection rates of magnetic fields including the effects of viscosity. Park, W.; Monticello, D.A.; White, R.B. (Plasma Physics Laboratory, Princeton University, Princeton, New Jersey 08544). *Physics of Fluids;* **27**: No. 1, 137-149(Jan 1984). Contract AC02-76CH03073.

The Sweet—Parker and Petschek scalings of the magnetic reconnection rate are modified to include the effect of the viscosity. The modified scalings show that the viscous effect can be important in high-β plasmas. The theoretical reconnection scalings are compared with numerical simulation results in a tokamak geometry for three different cases: a forced reconnection driven by external coils, the nonlinear m = 1 resistive internal kink, and the nonlinear m = 2 tearing mode. In the first two cases, the numerical reconnection rate agrees well with the modified Sweet—Parker scaling when the viscosity is sufficiently large. When the viscosity is negligible, a steady state which was assumed in the derivation of the reconnection scalings is not reached and the current sheet in the reconnection layer either remains stable through sloshing motions of the plasma or breaks up to higher m modes. When the current sheet remains stable, a rough comparison with the Sweet—Parker scaling is obtained. In the nonlinear m = 2 tearing mode case where the instability is purely resistive, the reconnection occurs on the slower dissipation time scale (psi-dot/sub s/~eta). In addition, experimental data of the nonlinear m = 1 resistive internal kink in tokamak discharges are analyzed and are found to give reasonable agreement with the modified Sweet—Parker scaling.

9094 Determination of laser intensity and hot-electron temperature from fastest ion velocity measurement on laser-produced plasma. Tan, T.H.; McCall, G.H.; Williams, A.H. (University of California, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physics of Fluids;* **27**: No. 1, 296-301(Jan 1984).

Measurements of the velocity of the fastest ion emitted by a CO_2-laser-produced plasma were made, and it was found that the relationship between velocity and laser flux was given by V/sub i/ = 5.7 x 10^6 phi/sup 1/6//sub l/ for single-beam illumination. Comparison with computer simulation, ion velocity spectrum, and x-ray data indicate that the hot-electron temperature is given by T/sub h/ = 7.5 x 10^{-19} V^3/sub i/. Measurements of emission from multiple-beam experiments and from experiments at 1.06 μm wavelength

are also described. Some simple models are used for discussion and correlation of the data.

9095 **Grazing incidence time-resolving spectrograph for magnetic fusion plasma diagnostics.** Hodge, W.L.; Stratton, B.C.; Moos, H.W. (Department of Physics, Johns Hopkins University, Baltimore, Maryland 21218). *Review of Scientific Instruments;* **55**: No. 1, 16-24(Jan 1984). Contract AC02-76ET53006.

A time-resolving grazing incidence spectrograph based on an image intensified photodiode array detector has been constructed and has demonstrated its utility as a fusion plasma diagnostic. The total wavelength coverage is 15—360 A with 0.7 A resolution (line profile FWHM); portions of this range may be observed during a single plasma discharge with a bandwidth of ~40 A when the detector is centered at 40 A and ~80 A with it centered at 200 A. Integration times from 5.4 to 13.1 ms are available when the entire photodiode array is read out; integration times as short as 1 ms can be obtained for a few lines of interest through the readout of selected photodiodes. The spectrograph has been radiometrically calibrated over the 60- to 360-A range at the NBS SURF II electron storage ring and is currently in operation on the Princeton Large Torus (PLT) tokamak.

9096 **Flash x-ray source for plasma shutter diagnostics.** Bradley, L.P.; Mitchell, A.C.; Johnson, Q.; Smith, I.D. (University of California, Lawrence Livermore National Laboratory, Livermore, California 94550). *Review of Scientific Instruments;* **55**: No. 1, 25-34(Jan 1984). Contract W-7405-ENG-48.

A flash x-ray source has been fabricated to examine the plasma-driven shutter for the Nova Fusion Laser System at the Lawrence Livermore National Laboratory. This source has a 20-ns pulse width and 1.5- and 4.5-keV x rays. It has been used to characterize plasma moving at 1—5 cm/μs with areal densities down to 0.1 mg/cm^2 and a spatial resolution of 2.5 μm. By using this x-ray source to diagnose the Nova plasma shutter, the authors were able to discover and cure sources of plasma nonuniformity and empirically select the foil dimensions and the current required for Nova.

9097 **Transport associated with the collisionless detrapping/retrapping orbits in a nonaxisymmetric torus.** Shaing, K.C.; Rome, J.A.; Fowler, R.H. (Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). *Physics of Fluids;* **27**: No. 1, 1-4(Jan 1984). Contract W-7405-ENG-26.

The differences among the various scalings in the transport calculations associated with the collisionless detrapping/retrapping orbits in a nonaxisymmetric torus are clarified. A simple random walk argument indicates that these differences are mainly due to an implicit assumption made about the retrapping rate of the toroidally trapped particles.

9098 **Possible plasma-dynamo mechanism driven by particle transport.** Jacobson, A.R. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physics of Fluids;* **27**: No. 1, 7-9(Jan 1984).

A new plasma-dynamo mechanism is proposed, with application to the outer region of the reversed-field pinch. The mechanism uses space-charge electric fields associated with particle transport to drive steady-state electrical currents which otherwise would resistively decay for lack of an externally applied electric field. The mechanism is suggested by recent observations during sustained discharges in the ZT-40M experiment.

9099 **Exact time-dependent solutions of the Vlasov—Poisson equations.** Lewis, H.R.; Symon, K.R. (Los Alamos National Laboratory, University of California, Los Alamos, New Mexico 87545). *Physics of Fluids;* **27**: No. 1, 192-196(Jan 1984).

The Vlasov—Poisson equations are relevant to collisionless plasmas and to stellar dynamics. They can be solved in one spatial dimension for an interesting class of cases by using a recent result about exact invariants of the motion of a particle in a one-dimensional potential. Lewis and Leach have given the necessary and sufficient conditions on the potential energy V(x,t) that an invariant which is quadratic in the momentum exist. For such a V(x,t), they exhibit the invariant explicitly. This result can be used to find the solutions of the one-dimensional Vlasov—Poisson equations for which the distribution functions are functions of quadratic functions of the momenta. A special case is the class of locally Maxwellian time-dependent solutions. The solutions for a single-species plasma, or a multispecies plasma where the charge to mass ratios are all equal, can be obtained by translating stationary solutions of the Vlasov—Poisson equations rigidly with an arbitrarily time-dependent displacement. If the charge to mass ratios of a multispecies plasma are unequal, then the solutions can be obtained by translating stationary solutions of modified Vlasov—Poisson equations with a displacement that depends quadratically on time. The modified Vlasov—Poisson equations include a species-dependent pseudogravity or ponderomotive force. This technique can be extended to obtain solutions of the Vlasov—Poisson or Vlasov—Maxwell equations in three dimensions.

9100 **Device for loading thin wires in a vacuum.** Kania, D.R. (Department of Nuclear Engineering, The University of Michigan, Ann Arbor, Michigan 48109). *Review of Scientific Instruments;* **55**: No. 1, 39-41(Jan 1984).

A simple device has been developed to load thin (25 μm in diameter) wires in vacuum for an exploding wire plasma system. Wires may be loaded with high reliability, straight, and accurately positioned. An improvement in the reproducibility of the wire explosion results and is attributed to the ability to repeatedly form the electrical contacts between wire and electrodes.

9101 **Upper hybrid loss-cone instability in tandem mirror thermal barriers.** Porkolab, M. (Lawrence Livermore National Laboratory, University of California, Livermore, California 94550). *Physics of Fluids;* **27**: No. 1, 162-169(Jan 1984). Contract W-7405-ENG-48.

Electrostatic instabilities with frequencies in the vicinity of the upper hybrid frequency are studied. Such instabilities may be excited in electron cyclotron resonance heating (ECRH) plasmas where a warm Maxwellian and a hot loss-cone component may exist simultaneously. Temporal and convective growth rates are calculated for parameters relevant to present-day tandem mirror and ELMO Bumpy Torus (EBT) devices. It is found that such modes may grow convectively to significant levels in the thermal barrier region of tandem mirrors.

9102 **Electromagnetic oscillating two-stream instability near the electron cyclotron frequency in a plasma.** Tripathi, V.K.; Tsai, S.T.; Liu, C.S. (Laboratory for Plasma and Fusion Energy Studies, University of Maryland, College Park, Maryland 20742). *Physics of Fluids;* **27**: No. 1, 170-174(Jan 1984).

The electromagnetic oscillating two-stream instability of electron cyclotron waves in a plasma has been examined. The low-frequency perturbation is a purely growing electromagnetic mode having k vector parallel to the ambient B field and the sidebands are elecrostatic plasma waves. The instability is excited when either ω/sub c/, ω/sub p/> or =ω$_0$ > or =(ω^2/sub p/+ω^2/sub c//4)^1/sup //^{2} -ω/sub c//2 or ω/sub u/>ω$_0$>ω/sub c/,ω/sub p/. Here ω$_0$ is the frequency of the pump and ω/sub c/,ω/sub p/, and ω/sub u/ are the electron cyclotron, plasma, and upper-hybrid frequencies, respectively. The threshold power, due to the finite extent of the pump, is a few hundred kilowatts for the parameters of large tori. The growth rate above the threshold γ≈ω$_0$ k$_0$v^2/sub 0x//8k^{2}v^2/sub e/, where v/sub 0x/ and v/sub e/ are the oscillatory and thermal speeds of electrons.

9103 **Kinetic theory of two-plasmon decay.** Powers, L.V.; Berger, R.L. (KMS Fusion, Inc., Ann Arbor, Michigan 48106). *Physics of Fluids;* **27**: No. 1, 242-246(Jan 1984). Contract AC08-82DP40152.

The Vlasov—Maxwell theory of two-plasmon decay is developed for homogeneous and weakly inhomogeneous plasmas. Temporal growth rates in homogeneous plasmas and spatial amplification in weakly inhomogeneous plasmas are calculated and compared to fluid theory. For hot plasmas (Te> or ≈10 keV) the kinetic analysis predicts lower growth rates and a reduced range of unstable wavenumbers compared to fluid theory.

9104 Symmetric regularized-long-wave equation. Seyler, C.E.; Fenstermacher, D.L. (Laboratory of Plasma Studies and School of Electrical Engineering, Cornell University, Ithaca, New York 14853). *Physics of Fluids;* **27**: No. 1, 4-7(Jan 1984). Contract AC02-80ER10569.

A symmetric version of the regularized-long-wave equation is shown to describe weakly nonlinear ion acoustic and space-charge waves. The equation possesses hyperbolic secant squared solitary waves and has four known invariants. Numerical solutions are compared with previous results on the regularized-long-wave equation.

9105 Parametric absorption in electron cyclotron resonance heating of tokamak plasmas. Stefan, V.; Bers, A. (Plasma Fusion Center, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). *Physics of Fluids;* **27**: No. 1, 175-183(Jan 1984). Contract AC02-78ET51013.

A theoretical study of parametric absorption in electron cyclotron resonance heating (ECRH) of tokamak plasmas is presented. The problem of primary and secondary decays including their temporal and spatial growth rates is studied. In the nonlinear phase of development of the excited waves, a cascading saturation mechanism is invoked for both convective and absolute instabilities. Anomalous absorption frequencies and anomalous absorption lengths are evaluated for a variety of parametric excitations.

9106 Low-amplitude, wave-induced particle energy diffusion in an inhomogeneous magnetic field. Riyopoulos, S.; Antonsen, T.M. Jr.; Ott, E. (Laboratory for Plasma and Fusion Energy Studies, University of Maryland, College Park, Maryland 20742). *Physics of Fluids;* **27**: No. 1, 184-191(Jan 1984).

The motion of a charged particle in a static, homogeneous magnetic field and a coherent electrostatic wave, whose frequency is much greater than the particle gyrofrequency, has been studied in detail by Karney. Karney found that there is a threshold in wave amplitude above which widespread diffusion of the particle energy (i.e., heating) occurs and below which the particle energy remains bounded. In this paper the effect of an inhomogeneous (or time-varying) magnetic field is examined. It is found that under general circumstances the motion of the particle can become diffusive and unbounded for values of the wave amplitude well below the threshold in the constant magnetic field case. The dependence of this diffusion on the various parameters affecting the motion is examined.

9107 Stability of Langmuir waves in developing ion-sound turbulence. DuBois, D.F.; Pesme, D. (Theoretical Division, Los Alamos National Laboratory, Los Alamos, New Mexico 87545 and Institute for Theoretical Physics, Santa Barbara, California 93106). *Physics of Fluids;* **27**: No. 1, 218-227(Jan 1984).

It is shown, using weak turbulence theory, that Langmuir waves are stabilized by a nonresonant quasilinear scattering of Langmuir waves by ion-sound waves in the presence of a background of developing ion-sound turbulence. This effect, which prevents the conversion of ion-sound turbulence into Langmuir turbulence in this transient regime, was ignored in previous theories. The destabilizing effect of the so-called "induced bremmastrahlung" of Langmuir waves as proposed by Nambu is furthermore shown to vanish exactly. The need for a renormalized theory in the case of steady-state ion-sound turbulence is discussed.

9108 High-power coherent microwave generation from oscillating virtual cathodes. Kwan, T.J.T. (Theoretical Applications Division, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physics of Fluids;* **27**: No. 1, 228-232(Jan 1984).

The formation of an oscillating virtual cathode by a relativistic electron beam and the subsequent generation of coherent microwaves are investigated. If the electron beam is of high quality, the microwaves excited in a cylindrical waveguide are found to occupy a very narrow band ($\Delta\omega/\omega \sim 5\%$) primarily in a single transverse magnetic mode. Furthermore, the efficiency of microwave production is demonstrated in our computer simulations to be as high as 20%. It is also shown quantitatively that the efficiency decreases monotonically as the mean scattering angle of the electron beam increases.

9109 Birth: A Neutral Beam Deposition Code for Non-Circular Tokamak Plasma. Otsuka, M.; Nagami, M.; Matsuda, T. (Japan Atomic Energy Research Institute, Ibaraki, Japan at the General Atomic Company, San Diego, California). *Journal of Computational Physics;* **52**: No. 2, 219-413(Nov 1983). Contract AT03-80SF11512.

A new neutral beam deposition code has been developed which is capable of calculating fast ion deposition profiles including the orbit correction. The code incorporates any injection geometry and a non-circular cross-section plasma with a variable elongation and an outward shift of the magnetic flux surface. Typical CPU time on a KL DEC-10 computer is 10—20 s and 5—10 s with and without the orbit correction, respectively. This is shorter by an order of magnitude than that of other codes, e.g., Monte Carlo beam deposition codes. The power deposition profile calculated by this code is in good agreement with that calculated by the Monte Carlo code which was developed to calculate the complete behaviors of the fast ions in circular plasmas.

9110 Pulsed electromagnetic acceleration of exploded wire plasmas. Peratt, A.L.; Koert, P. (Advanced Concepts and Plasma Physics Group, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Journal of Applied Physics;* **54**: No. 11, 6292-6301(Nov 1983).

A simple analysis of the dynamic state of a current-conducting high-density plasma column, resulting from an exploded wire between the conductors of a rail-gun accelerator or one or more wires strung between the anode and cathode conductors in a pulsed-power generator diode, is given on the basis of a one-dimensional magnetohydrodynamics model. Spatial distributions of the current density, magnetic field, temperature, and particle density are calculated as well as the temporal current, voltage, and impedance histories. The model self-consistently treats the accelerator load transition through its solid, melt, vapor, and plasma states in the presence of its supply source and feed network. Once formed and accelerated, the plasma state calculations show expansion cooling across the self-induced magnetic field if the Bennett condition is not satisfied. The model predictions are compared to two experimental situations. The first involves the delivery of some hundreds of Joules of stored energy to the wire load. For this case, good agreement between the calculated and observed plasma state is obtained. The second situation involves the delivery of many thousands of Joules to the wire load. For this case and dependent upon the wire mass, diameter, number of wires exploded, their separation, and the pulsed energy electrical wave shapes, the magnetohydrodynamic results can be qualitatively incorrect. The necessity of an electromagnetic particle simulation approach is indicated in order to resolve the magnetic rope-like structure and filamentation observed in the very energetic plasmas.

9111 Ion-trapping saturation of the Brillouin instability. Clayton, C.E.; Joshi, C.; Chen, F.F. (Electrical Engineering Department, University of California, Los Angeles, California 90024). *Physical Review Letters;* **51**: No. 18, 1656-1659(31 Oct 1983). Contract AS08-81DP40163.

The ion acoustic wave and harmonics driven by stimulated Brillouin scattering are probed by space- and time-resolved ruby-laser Thomson scattering. Corresponding to the 6% backscatter observed, the ion wave is seen to saturate at (5—10)% amplitude, a level quantitatively predictable from the nonlinear frequency shift caused by ion trapping.

9112 Three-dimensional instability of magnetic islands. Bondeson, A. (Institute for Electromagnetic Field Theory, Chalmers University of Technology, S-41296 Goeteborg, Sweden and Laboratory for Fusion and Energy Studies, University of Maryland, College Park, Maryland 20742). *Physical Review Letters;* **51**: No. 18, 1668-1671(31 Oct 1983).

The three-dimensional stability of magnetic equilibria with islands is investigated with use of reduced magnetohydrodynamics. It is found numerically that tokamak equilibria with large $m/n = 2$ islands can be ideally unstable. The instability is explained by the

strongly modified q profile in the helical equilibrium, where the q = (3/2),(5/3), . . . resonant surfaces are all close to the inner separatrix of the islands. An analytic treatment of the three-dimensional coalescence instability is given to illustrate this effect.

9113 **Numerical treatment of the axial singularity in a flux coordinate system for particle simulation.** Kuo-Petravic, G. *Journal of Computational Physics;* **52**: No. 1, 209-216(Oct 1983). Contract AC02-76CH03073.

A coordinate system transformation is introduced that improves computer plasma simulation calculations. (AIP)

9114 **Comparison of MHD stability results obtained with the BETA 3D andd HERA 2D codes.** Betancourt, O.; Herrnegger, F.; Merkel, P.; Nuehrenberg, J.; Gruber, R.; Troyon, F. (Courant Institute of Mathematical Sciences, New York University, New York, New York 10012). *Journal of Computational Physics;* **52**: No. 1, 187-208(Oct 1983). Contract AC02-76ER03077.

Comparison of MHD stability results obtained for helically symmetric equilibria with two codes, HERA and BETA, showed excellent agreement in growth rates and marginal stability parameters. While HERA is the helical version of the ERATO linearized 2D stability code, BETA obtains nonlinear 3D equilibria and their (nonlinear) stability properties. The cases studied comprise internal, i.e., fixed plasma boundary, resonant and nonresonant modes in low-shear equilibria with intermediate and small β values.

9115 **MeV light atom beams for heating and/or diagnostics of tokamak plasmas.** Grisham, L.R.; Mikkelsen, D.R.; Post, D.E. (Princeton Univ., Plasma Physics Lab., Princeton, NJ 08544). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **30**: No. 2, 1179-1182(Apr 1983).

The authors have studied the possible usefulness and feasibility of multi-MeV beams of light atoms ($6 \leqq A \leqq 30$) for applications in magnetically confined plasmas. These potential applications include plasma heating or current drive, and as a diagnostic to probe the velocity distribution function of the confined energetic alpha particles which result from fusion reactions between deuterium and tritium. The combined current and energy requirements for these applications appear to preclude the use of electrostatic acceleration. However, electric-quadrupole-focused RF linear accelerators such as the radio frequency quadrupole (being developed at LASL) or the MEQALAC (at BNL) appear to be promising technologies.

9116 **An application of SIMS to fusion energy research: determination of ion impact desorption cross sections.** Bastasz, R. (Sandia Natl. Lab., Livermore, CA 94550). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **30**: No. 2, 1183-1186(Apr 1983).

Measurements of plasma effects on materials are required in the design and evaluation of fusion reactor components. One of the more prevalent effects is ion impact desorption (IID) of surface impurities, which may influence plasma temperatures and fuel recycling rates. This paper describes the application of secondary ion mass spectrometry (SIMS) to measure IID processes. SIMS is well suited for laboratory measurements of plasma effects since the ion beam used for analysis also simulates the energetic particle flux emanating from a plasma. This attribute can be utilized to obtain IID cross sections. A lowenergy ion accelerator, which produces mass-analyzed, neutral-free beams of H^+_1, H^+_2, and H^+_3 is used as a primary ion source. The release of impurities from a wall sample due to IID is monitored by observing the appropriate secondary ion emission rate. Cross sections for various ion, impurity, substrate combinations are determined as functions of incident ion energy and impact angle. This information is then used to calculate impurity release rates expected during reactor operation.

9117 **A high energy D2O submillimeter laser for plasma diagnostics.** Semet, A.; Johnson, L.C.; Mansfield, D.K. (Princeton Univ., NJ). *International Journal of Infrared and Millimeter Waves;* **4**: 231-246(Mar 1983). Contract AC02-76CH03073.

A narrow line optically pumped D2O laser operating at 385 microns has delivered more than 5J in pulses longer than 3 microseconds using a large aperture unstable resonator cavity design. Pulse levels greater than 1J, 1 microsecond are necessary for a single shot ion temperature measurement by Thomson scattering in large tokamaks. Experiments have, for the most part, been conducted at a 360J, 5 microsecond CO2 laser pump level where high efficiency (approximately 2.5 J at 385 microns) has been obtained. These are the highest energies reported to date in the far infrared. In addition, the pulse length has been extended beyond the vibrational relaxation time.

9118 **Lower hybrid heating and current drive system for a tokamak reactor.** Ehst, D.A.; Boley, C.D.; Evans, K. Jr.; Hino, T.; Jung, J.; Trachsel, C.A. (Fusion Power Program, Argonne National Laboratory, Argonne, Illinois 60439). *Journal of Fusion Energy;* **2**: No. 1, 83-109(Feb 1982).

A lower hybrid heating system has been designed for heating a tokamak reactor to ignition and for sustaining steady-state operation by driving the toroidal plasma current. The power spectrum from an active/passive waveguide grill is computed, and the resulting equilibrium current density profile is computed from a full electromagnetic WKB analysis of wave propagation in a cylinder. The corresponding toroidal current profile is a low-current equilibrium which is stable to various ideal modes at an economically acceptable beta. The electronic circuitry is designed to minimize the electric power required for current drive, and the resulting design appears to provide reliable operation in a reactor environment. The same system can drive current during reactor startup if some of the waveguides are modified slightly. A typical sequence of startup equilibria is calculated.

9119 **Investigations of a thermally produced plasma.** Braithwaite, N.St.J. Oxford, England; Oxford University (1981). 221p. British Library, Boston Spa, Wetherby, West Yorks. No. D44168/83.

A caesium plasma generated and confined within a heated, annular tantalum cavity is investigated. Time-independent algebraic models are described which involve the self-consistent distribution of potential between the electrodes when a potential difference is applied across them. The temporal stability of the current-carrying plasma is considered by means of linear perturbations to the time-independent models. The streaming of electrons through the plasma gives rise to instability on electron and ion timescales. Experimental measurements of the steady state and the rapid response show broad agreement with the time-independent models. An experimental model of the plasma diode, a numerical particle simulation is used to examine the effects of finite geometry on the stability of the plasma and to provide a second system to which the theoretical models might be applied. Some of the modelling is also appropriate to certain types of Q-machines.

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REFER ALSO TO CITATION(S) 7846, 7847, 7848, 7854, 7855, 7856, 7857, 7858, 7859, 7860, 7861, 7862, 7863, 7881, 7902, 7903, 7904, 7905, 7906, 7907, 7909, 7910, 7911, 7912, 7913, 7914, 7915, 7916, 7917, 8035, 8036, 8037, 8038, 8039, 8243, 8272, 8469, 9096, 9103

9120 **(AD-A—131275/0) Alternate implosion models for the plane parallel diode. Final report, 1 November 1980-1 November 1981.** Terry, R.E. (JAYCOR, Alexandria, VA (USA)). 2 Apr 1982. 90p. (J—207-82-002). NTIS, PC A05/MF A01.

The evolution of imploding Z-pinch plasmas in a plane parallel diode is modeled in two ways through the computer code ZDIPR, described here. The first consists in a complete electromagnetic field solution via the appropriate Hertz vector potential, combined with a radiation coupled hydrodynamic solution of the Braginskii fluid equations. The second, in an approximate electrodiffusive solution for the axial electric field, combined with the radiation coupled hydrodynamic model. The hydrodynamic solution is effected by an implicit advance of ion temperature, electron temperature plus chemical potential, and (in the electrodiffusive limit) the axial electric field. This is subcycled under the control of either

a predictor/corrector or fully implicit advance of the radial fluid velocity and Lagrangian position coordinate. Radiation transport is calculated by probability of escape algorithms operating on a preselected set of frequency domains. The elcetromagnetic field advance is effected through wave equation quadrature (for Z and derivative sub tZ) followed by a numerical differentiation of this potential (smoothly interpolated to the fluid mesh) which provides E sub Z and B sub theta.

9121 **(CONF-820948—15) Pellet fueling development at Oak Ridge National Laboratory.** Foster, C.A.; Milora, S.L.; Schuresko, D.D.; Combs, S.K.; Lunsford, R.V. (Oak Ridge National Lab., TN (USA)). 1982. Contract W-7405-ENG-26. 6p. NTIS, PC A02/MF A01. Order Number DE84004691.

From 12. symposium on fusion technology; Juelich, F.R. Germany (13 Sep 1982).

A pellet injector development program has been under way at the Oak Ridge National Laboratory (ORNL) since 1976 with the goals of developing D_2, T_2 pellet fuel injectors capable of reliable repetitive fueling of reactors and of continued experimentation on contemporary plasma devices. The development has focused primarily on two types of injectors that show promise. One of these injectors is the centrifuge-type injector, which accelerates pellets in a high speed rotating track. The other is the gas or pneumatic gun, which accelerates pellets in a gun barrel using compressed helium of H_2 gas.

9122 **(CONF-820948—16) FED reactor engineering features.** Sager, P.H.; Brown, T.G.; Fuller, G.M.; Smith, G.E. (Oak Ridge National Lab., TN (USA); GA Technologies, Inc., San Diego, CA (USA); Grumman Aerospace Corp., Bethpage, NY (USA); McDonnell Douglas Astronautics Co., St. Louis, MO (USA)). 1982. Contract W-7405-ENG-26;AT03-76ET51011. 7p. NTIS, PC A02/MF A01. Order Number DE84004451.

From 12. symposium on fusion technology; Juelich, F.R. Germany (13 Sep 1982).

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The Fusion Engineering Device (FED) Baseline design incorporates a number of features which were selected to enhance its maintainability, as well as limit cost and achieve reliable operation. An installation of ten TF coils and ten torus sectors was selected on the basis of plasma chamber segmentation studies and TF coil cost tradeoff studies, permitting removal of a torus sector with a single radial motion. The design also features a shield sector support spool which provides a plasma chamber vacuum boundary and access to the shield sectors. The vacuum seals are made at the outboard face of the torus so that they can be readily cut and rewelded. A pumped limiter provides plasma edge definition and impurity control. Ten individual blades are inserted through the shield sector in an arrangement that permits replacement without sector removal. ICRH is used for plasma bulk heating. Two EF coils, which are located inside the TF coil bore, are segmented so that they can be removed if necessary. The removal of the superconducting lower outboard EF coil, which is trapped under the TF coil assembly, presents a problem; consideration is being given to increasing its diameter and relocating it so that it can be lifted up around the TF coils.

9123 **(CONF-820948—17) Employment of the Large Coil Test Facility in toroidal field coil development.** Haubenreich, P.N.; Bohanan, R.E.; Luton, J.N.; May, J.R.; Miller, H.E.; Ryan, T.L. (Oak Ridge National Lab., TN (USA)). 1982. Contract W-7405-ENG-26. 6p. NTIS, PC A02/MF A01. Order Number DE84004449.

From 12. symposium on fusion technology; Juelich, F.R. Germany (13 Sep 1982).

The international Large Coil Task (LCT), involving EURATOM, Japan, Switzerland, and the United States, is developing competing concepts of superconducting toroidal field coils. Six different coils will be tested together in the Large Coil Test Facility (LCTF). All participants are collaborating in planning and will share all test data.

9124 **(CONF-821108—33) Error field generation of solenoid magnets.** Saunders, J.L. (General Dynamics Corp., San Diego, CA (USA). Convair Div.). 1982. Contract W-7405-ENG-26. 9p. NTIS, PC A02/MF A01. Order Number DE84003373.

From Applied superconductivity conference; Knoxville, TN, USA (30 Nov 1982).

Many applications for large solenoids and solenoidal arrays depend on the high precision of the axial field profile. In cases where requirements of $\Delta B/B$ for nonaxial fields are on the order of 10^{-4}, the actual winding techniques of the solenoid need to be considered. Whereas an ideal solenoid consisting of current loops would generate no radial fields along the axis, in reality, the actual current-carrying conductors must follow spiral or helical paths. A straightforward method for determining the radial error fields generated by coils wound with actual techniques employed in magnet fabrication has been developed. The method devised uses a computer code which models a magnet by sending a single, current-carrying filament along the same path taken by the conductor during coil winding. Helical and spiral paths are simulated using small, straight-line current segments. This technique, whose results are presented in this paper, was used to predict radial field errors for the Elmo Bumpy Torus-Proof of Principle magnet. These results include effects due to various winding methods, not only spiral/helical and layer-to-layer transitions, but also the effects caused by worst-case tolerance conditions both from the conductor and the winding form (bobbin). Contributions made by extraneous circuitry (e.g., overhead buswork and incoming leads) are also mentioned.

9125 **(CONF-821108—34) Short circuit detection in the winding and operation of superconducting magnets.** Walstrom, P.L. (Oak Ridge National Lab., TN (USA)). 1982. Contract W-7405-ENG-26. 4p. NTIS, PC A02/MF A01. Order Number DE84004678.

From Applied superconductivity conference; Knoxville, TN, USA (30 Nov 1982).

Three categories of shorts will be discussed: (1) shorts to the metallic bobbin or other structural elements, (2) shorts between turns caused by instrumentation wires that are deliberately connected to a turn at the end (e.g., voltage taps) and that short out to another turn but are not completely severed in the process, and (3) short circuits between turns caused by direct contact due to insulation failure by chips of metal bridging turns and by instrumentation wires that bridge turns but are severed in the process of shorting.

9126 **(CONF-821111—26) Solid deuterium centrifuge pellet injector.** Foster, C.A. (Oak Ridge National Lab., TN (USA)). 1982. Contract W-7405-ENG-26. 28p. NTIS, PC A03/MF A01. Order Number DE84004690.

From 29. national symposium of American Vacuum Society; Baltimore, MD, USA (16 Nov 1982).

Pellet injectors are needed to fuel long pulse tokamak plasmas and other magnetic confinement devices. For this purpose, an apparatus has been developed that forms 1.3-mm-diam pellets of frozen deuterium at a rate of 40 pellets per second and accelerates them to a speed of 1 km/s. Pellets are formed by extruding a billet of solidified deuterium through a 1.3-mm-diam nozzle at a speed of 5 cm/s. The extruding deuterium is chopped with a razor knife, forming 1.3-mm right circular cylinders of solid deuterium. The pellets are accelerated by synchronously injecting them into a high speed rotating arbor containing a guide track, which carries them from a point near the center of rotation to the periphery. The pellets leave the wheel after 150° of rotation at double the tip speed. The centrifuge is formed in the shape of a centrifugal catenary and is constructed of high strength KEVLAR/epoxy composite. This arbon has been spin-tested to a tip speed of 1 km/s.

9127 **(CONF-831203—33) Progress of the Argonne Pulsed Cable Test Facility.** Kim, S.H.; Knott, M.J.; Krieger, C.I.; McGhee, D.G. (Argonne National Lab., IL (USA)). 1983. Contract W-31-109-ENG-38. 4p. NTIS, PC A02/MF A01. Order Number DE84004011.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

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Initial tests of the Pulsed Cable Test Facility (PCTF) at Argonne National Laboratory (ANL) have been completed. Additional components are prepared for the tests of developmental high-current cable conductors: a minicomputer based data acquisition system, a new 5.5 MW power supply for triangular or trapezoidal pulsing modes of the PCTF coil, and a pair of 25 kA current leads for the transport current of the testing conductors.

9128 **(CONF-831203—34) FELIX: construction and testing of a facility to study electromagnetic effects for first wall, blanket, and shield systems.** Praeg, W.F.; Turner, L.R.; Biggs, J.A.; Knott, M.J.; Lari, R.J.; McGhee, D.G.; Wehrle, R.B. (Argonne National Lab., IL (USA)). 1983. Contract W-31-109-ENG-38. 9p. NTIS, PC A02/MF A01. Order Number DE84004012.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

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An experimental test facility for the study of electromagnetic effects in the FWBS systems of fusion reactors has been constructed over the past 1-1/2 years at Argonne National Laboratory (ANL). In a test volume of 0.76 m^3 a vertical pulsed 0.5 T dipole field ($B < 50$ T/s) is perpendicular to a 1 T solenoid field. Power supplies of 2.75 MW and 5.5 MW and a solid state switch rated 13 kV, 13.1 kA (170 MW) control the pulsed magnetic fields. The total stored energy in the coils is 2.13 MJ. The coils are designed for a future upgrade to 4 T or the solenoid and 1 T for the dipole field (a total of 23.7 MJ). This paper describes the design and construction features of the facility. These include the power supplies, the solid state switches, winding and impregnation of large dipole saddle coils, control of the magnetic forces, computer control of FELIX and of experimental data acquisition and analysis, and an initial experimental test setup to analyze the eddy current distribution in a flat disk.

9129 **(CONF-831203—35) TRIO-01 experiment: in-situ tritium recovery results.** Clemmer, R.G.; Finn, P.A.; Billone, M.C.; Misra, B.; Greenwood, L.R.; Dyer, F.F.; Dudley, I.T.; Bate, L.C.; Clemmer, E.D.; Fisher, P.W. (Argonne National Lab., IL (USA); Oak Ridge National Lab., TN (USA)). 1983. Contract W-31-109-ENG-38. 9p. NTIS, PC A02/MF A01. Order Number DE84004003.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

The TRIO-01 experiment was designed to test in-situ tritium recovery and heat transfer performance of a candidate solid breeder, γ-$LiAlO_2$. The results showed that nearly all the tritium generated was recovered. Only < 0.1 wppM tritium remained in the solid after irradiation testing. The heat transfer performance showed that temperature profiles can be effectively controlled.

9130 **(CONF-831203—41) Calibrations of a tritium extraction facility.** Bretscher, M.M.; Oliver, B.M.; Farrar, H. IV. (Argonne National Lab., IL (USA); Rockwell International Corp., Canoga Park, CA (USA). Energy Systems Group). 1983. Contract W-31-109-ENG-38. 6p. NTIS, PC A02/MF A01. Order Number DE84004033.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

A tritium extraction facility has been built for the purpose of measuring the absolute tritium concentration in neutron-irradiated lithium metal samples. Two independent calibration procedures have been used to determine what fraction, if any, of tritium is lost during the extraction process. The first procedure compares independently measured ^4He and ^3H concentrations from the $^6Li(n,\alpha)T$ reaction. The second procedure compared measured $^6Li(n,\alpha)T$/ $^{197}Au\ (n,\gamma)^{198}Au$ thermal neutron reaction rate ratios with those obtained from Monte Carlo calculations using well-known cross sections. Both calibration methods show that within experimental errors ($\sim$ 1.5%) no tritium is lost during the extraction process.

9131 **(CONF-831203—55-Draft) Plasma engineering analysis of Tennessee Tokamak.** Yokoyama, K.E.; Lacatski, J.T.; Miller, J.B.; Bryan, W.E.; King, P.W.; Santoro, R.T.; Shannon, T.E.; Uckan, N.A. (Tennessee Univ., Knoxville (USA). Dept. of Nuclear Engineering; Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 23p. NTIS, PC A02/MF A01. Order Number DE84004692.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

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This paper summarizes the results of the plasma engineering and systems analysis studies for the Tennessee Tokamak (TENTOK) fusion power reactor. TENTOK is a 3000-MW(t) central station power plant that uses dueterium-tritium fuel in a D-shaped tokamak plasma configuration with a double-null poloidal divertor. Detailed analyses are performed in the areas of (1) transport simulation using the 1-1/2-D WHIST transport code, (2) equilibrium/poloidal field coil systems, (3) neutral beam and radiofrequency (rf) heating, and (4) pellet fueling. In addition, impurity control sytems, diagnostics and controls, and possible microwave plasma preheating and steady-state current drive options are also considered. Some of the major features of TENTOK include rf heating in the ion cyclotron range of frequencies, superconducting equilibrium field coils outside the superconducting toroidal field coils, a double-null poloidal divertor for impurity control and alpha ash removal, and rf-assisted plasma preheating and current startup.

9132 **(CONF-831203—61-Draft) Specifying the auxiliary heating system on TFCX.** Metzler, D.H. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 5p. NTIS, PC A02/MF A01. Order Number DE84004455.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

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This paper reviews the status of heating systems for the TFCX-S (all superconducting coil) and TFCX-H (hybrid coil) options. Three systems were defined; preheating (electron), current drive, and bulk (ion) heating. Application of systems engineering techniques facilitated fruitful discussions of requirements and their impact on equipment between physicists and engineers. A low-cost, flexible combination of systems allows plasma experiments using all rf startup and current drive.

9133 **(CONF-831203—63) MAGFOR: a magnetics code to calculate field and forces in twisted helical coils of constant cross section.** Cain, W.D. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 6p. NTIS, PC A02/MF A01. Order Number DE84004648.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

The machine-independent computer program MAGFOR calculates electromagnetic fields and forces in coil systems of arbitrary geometry. The coils may be modeled by using 20-node isoparametric hexahedrons; 8-node rectangular cross-sectional straight segments; rectangular cross-sectional circular arcs; and/or filamenting circular loops. A combination of analytical and numerical integration of the Biot-Savart law for a volume distribution of current is used for calculating magnetic fields. Volumetric body forces are calculated for the 20-node isoparametric brick by numerically integrating the vector product J x B over its volume, where the magnetic field at each Gauss point is obtained by interpolating the magnetic field at the node points by using shape functions. The force is distributed to the node points of the element, again using the shape functions in a consistent manner that maintains inter-element torsion. Body forces obtained from MAGFOR are compared with body forces from the computer code EFFI for several coil configurations considered in the design of the Advanced Toroidal Facility (ATF).

9134 **(CONF-831203—64) TFCX-S toroidal field coil design using a superfluid helium-cooled winding.** Kalsi, S.S.; Coffman, L.; Hooper, R.J. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 5p. NTIS, PC A02/MF A01. Order Number DE84004543.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

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This paper discusses the design and performance of the toroidal field (TF) coils for one of the possible options for the Tokamak Fusion Core Experiment (TFCX). TFCX is a proposed long-pulse, ignited next-step tokamak to follow the Tokamak Fusion Test Reactor (TFTR). In the TFCX option considered here, designated TFCX-S, there are 16 superconducting TF coils which produce 4.3 T at a plasma major radius of 3.75 m. Each of the TF coils is rated at 5.06 MAT, and operates at a peak field of 9.8 T at the winding. Several winding/cooling approaches have been considered for the TFCX-S TF coils. A NbTi winding, cooled by superfluid helium (He/sub II/) at 1.8 K, is discussed here. The conductor is similar to that being developed by GA Technologies as part of the Department of Energy (DOE) 12 T conductor development program. Use of either sub-cooled atmospheric pressure He/sub II/ or saturated sub-atmospheric pressure He/sub II/ has been considered; both cooling schemes appear feasible.

9135 (CONF-831203—65) Tokamak reactor startup power. Weldon, D.M.; Murray, J.G. (Los Alamos National Lab., NM (USA); Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 6p. NTIS, PC A02/MF A01. Order Number DE84004464.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

Tokamak startup with ohmic heating (OH)-induced voltages requires rather large voltages and power supplies. On present machines, with no radiofrequency (rf)-assist provisions, hundreds of volts have been specified for their designs. With the addition of electron cyclotron resonant heating (ECRH) assist, the design requirements have been lowered. To obtain information on the cost and complexity associated with this ECRH-assisted, OH-pulsed startup voltage for ignition-type machines, a trade-off study was completed. The Fusion Engineering Device (FED) configuration was selected as a model because information was available on the structure. The data obtained are applicable to all tokamaks of this general size and complexity, such as the Engineering Test Reactor (ETR).

9136 (CONF-831243—4) First 200 kW CW operation of a 60 GHz gyrotron. Jory, H.; Bier, R.; Evans, S.; Felch, K.; Fox, L.; Huey, H.; Shively, J.; Spang, S. (Varian Associates, Inc., Palo Alto, CA (USA)). 1983. Contract W-7405-ENG-26. 14p. NTIS, PC A02/MF A01. Order Number DE84004573.

From International electron device meeting; Washington, DC, USA (5 Dec 1983).

The gyrotron is a microwave tube which employs the electron cyclotron maser interaction to produce high power output at millimeter wavelengths. It has important and growing applications for heating of plasmas in controlled thermonuclear fusion experiments. The Varian 60 GHz gyrotron has recently generated microwave power in excess of 200 kW during CW operation, wth excellent dynamic range and operating stability. This is the highest average power ever produced by a microwave tube in the millimeter wave region. A description of the gyrotron design and test results are presented.

9137 (CONF-831245—2) Analysis of the output mode from 60 GHz, 200 kW pulsed and CW gyrotrons. Felch, K.; Bier, R.; Fox, L.; Huey, H.; Jory, H.; Manca, J.; Shively, J.; Spang, S.; Moeller, C. (Varian Associates, Inc., Palo Alto, CA (USA); GA Technologies, Inc., San Diego, CA (USA)). 1983. Contract W-7405-ENG-26. 6p. NTIS, PC A02/MF A01. Order Number DE84004586.

From 8. international conference on infrared and millimeter waves; Miami Beach, FL, USA (12 Dec 1983).

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A Varian 60 GHz, CW gyrotron has recently been operated at power levels up to 200 kW CW. The tube employs a TE_{011}/TE_{021} complex interaction cavity which inhibits mode competition by the TE_{021} mode with the desired TE_{021} mode. The output mode of the cavity is nominally in the TE_{02} circular waveguide mode in overmoded waveguide. Since the output waveguide also serves as the gyrotron collector, mode conversion occurs in the taper sections and gaps incorporated into the collector. Measurements of the mode conversion on a 60 GHz, 200 kw, 100 ms pulse tube, have been made and compared with similar measurements on the 60 GHz. 200 kW, CW gyrotron. These measurements indicated that the CW tube had significantly more conversion of the TE_{02} mode into other TE/sub on/ modes than did the pulse tube. Current design work is aimed at reducing the mode conversion of the CW design to the same levels as the pulse design ($\leq$ 10% mode converison).

9138 (CONF-8310229—6) Reconnection in tokamaks. Pare, V.K. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 22p. NTIS, PC A02/MF A01. Order Number DE84004695.

From Chapman conference on magnetic reconnection; Los Alamos, NM, USA (3 Oct 1983).

Calculations with several different computer codes based on the resistive MHD equations have shown that (m = 1, n = 1) tearing modes in tokamak plasmas grow by magnetic reconnection. The observable behavior predicted by the codes has been confirmed in detail from the waveforms of signals from x-ray detectors and recently by x-ray tomographic imaging.

9139 (DOE/DP/40124—10) Inertial fusion research at the University of Rochester: progress in direct drive. McCrory, R.L. (Rochester Univ., NY (USA). Lab. for Laser Energetics). 1983. Contract AC08-80DP40124. 23p. (CONF-831130—2). NTIS, PC A02/MF A01. Order Number DE84003691.

From Technical committee meeting on inertial confinement fusion research; Osaka, Japan (7 Nov 1983).

Portions are illegible in microfiche products.

Experiments at the University of Rochester's Laboratory for Laser Energetics (LLE) during the past year with both the 24-beam, 1054-nm OMEGA laser facility and the single-beam, 351-nm GDL system have concentrated on defining the uniformity and the physics of coronal coupling and energy transport in spherical geometry for short-wavelength, direct-drive laser fusion. In this paper, the role of LLE in the United States inertial fusion program is reviewed.

9140 (DOE/DP/40132—T1) High-energy fusion-product energy-loss measurements. Final technical report, January 1, 1981-December 31, 1983. Miley, G.H. (Illinois Univ., Urbana (USA). Fusion Studies Lab.). Dec 1983. Contract AS08-81DP40132. 187p. NTIS, PC A09/MF A01. Order Number DE84004887.

An experiment designed to examine the slowing down of charged fusion products in ICF plasmas was done. A time-of-flight spectrometer was used to simultaneously measure the energy spectra of D-T alphas and D_2 protons escaping from imploded glass microballoons. In order to model fusion-product slowing down in plasmas with nonclassical plasma parameters, the Ion-Sphere (or hard-sphere) potential has been used. The deceleration of fast test ions slowing down off of this potential has been calculated in a straightforward way. An interpolation between the classical slowing-down formula and the Ion-Sphere slowing-down expression in the region between classical and nonclassical plasmas has been derived. This expression, called the Ion-Sphere Interpolation Model, is valid for all fully ionized non-degenerate plasmas. Fusion-product energy deposition in the fuel is necessary for self-heating and burn-wave propagation - two effects required for high-gain ICF. The University of Illinois advanced fuel hydrodynamic-burn code, AFBURN, has been used to test the sensitivity of reactor-sized targets to dE/dx. It was found that strongly burning targets are insensitive to both factor of two changes in dE/dx and inclusion of large plasma parameter effects in dE/dx. It was also found that weakly burning targets exhibit a markedly increased sensitivity to these effects.

9141 (DOE/ER—0046/14) Damage analysis and fundamental studies. Quarterly progress report, April-June 1983. (USDOE Office of Energy Research, Washington, DC. Office of Fusion Energy). Aug 1983. 164p. NTIS, PC A08/MF A01. Order Number DE84002978.

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Separate abstracts were prepared for eleven of the included sections. (MOW)

9142 (DOE/ER—0046/14, pp 19-24) **Measurement of spallation cross sections at IPNS.** Greenwood, L.R.; Smither, R.K. (Argonne National Lab., IL). Aug 1983. NTIS, PC A08/MF A01.

In Damage analysis and fundamental studies. Quarterly progress report, April-June 1983.

Spallation cross sections for Al and Cu have been measured at the IPNS at Argonne National Laboratory. Results are reported for the Al reactions to ^{7}Be, ^{22}Na, and ^{24}Na at proton energies between 80 to 450 MeV. These reactions will be used to extend our dosimetry technique to higher energies and will improve damage and transmutation rates for accelerator-based neutron sources such as IPNS and FMIT.

9143 (DOE/ER/52090—1) **ICRF waveguide couplers. Progress report, February 1983-Aug 1983.** Scharer, J.E. (Wisconsin Univ., Madison (USA). Dept. of Electrical and Computer Engineering). Aug 1983. Contract AC02-83ER52090. 15p. NTIS, PC A02/MF A01. Order Number DE84004042.

Calculations were made for the reflection coefficient from a dielectric loaded TE_{10} waveguide operating at 54.8 MHz to a plasma with a prescribed density profile. Optimum waveguide proportions are determined to minimize reflections and the proper match point for a coaxial feed to match the system is determined. Future plans call for fabrication and field measurements of a prototype design and the design of an all metal launcher.

9144 (EGG-M—10383) **Ion-beam system for tritium permeation experiments.** Anderl, R.A.; Holland, D.F. (EG and G Idaho, Inc., Idaho Falls (USA)). 1983. Contract AC07-76ID01570. 6p. (CONF-831203—50). NTIS, PC A02/MF A01. Order Number DE84004230.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

An experimental facility has been developed to carry out permeation experiments for candidate first-wall materials subjected to high fluxes of energetic hydrogen isotope ions. The experimental facility consists of (a) an ion-beam system for production of intense, mass-analyzed ion beams with energies variable from 500 eV to 10 keV, (b) a target chamber system for directing an ion beam onto a heated target and for measuring various implantation-related experimental parameters, and (c) a downstream system for measuring the implanted gas which permeates the specimen. The target chamber and downstream system are equipped with diagnostic capabilities to permit simultaneous measurement of the permeation, reemission, and sputtering effects for target materials.

9145 (EPRI-AP—3283) **Assessment of technical risks and R and D requirements for a magnetic confinement fusion fuel system. Final report.** DeFreece, D.A. (McDonnell Douglas Astronautics Co., St. Louis, MO (USA)). Nov 1983. Contract W-7405-ENG-36;W-31-109-ENG-38. 345p. NTIS, PC A15/MF A01. Order Number DE84003890.

This report documents a specific use and results of a novel technique for assessing the technical risks associated with the hardware development of a possible future commercial fusion power plant fuel system. Technical risk is defined as the risk that a particular technology or component which is currently under development will not achieve a set of required technical specifications. A technical risk assessment is the quantification of this risk. This Technical Risk Assessment (TRA) methodology was applied to a deuterium-tritium fuel system for a magnetic-confinement fusion power plant. The fuel system is defined to support a generic commercial reactor with at least two viable options for each critical subsystem. Each subsystem option is defined in detail including nominal performance requirements and subsystem interfaces. Subsystem experts were canvassed to obtain values for past, present and future technical performance parameters for each of the subsystem options. These forecasts are presented as probabilities of achieving given levels of performance in specific time periods for assumed funding scenarios. Several funding scenarios were examined to discern whether performance limitations are caused by funding or technology. A computerized Fuel System simulation is described which uses these subsystem performance parameter forecasts as inputs.

9146 (GTFR—45) **Smaller coil systems for tokamak reactors.** Bateman, G.; Fox, J.R. (Georgia Inst. of Tech., Atlanta (USA)). Dec 1983. Contract AS05-78ET52025. 5p. (CONF-831203—42). NTIS, PC A02/MF A01. Order Number DE84004610.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

Ripple reduction by ferro-magnetic iron shielding is used to reduce the size of the toroidal field coils down to 7.8 by 10.4 m bore for a commercial tokamak reactor design with plasma parameters similar to STARFIRE. For maximum effectiveness, it is found that the blocks of ferromagnetic iron shielding should have triangular cross section and should be placed as close to the plasma as possible.

9147 (HEDL-SA—2889-FP) **Measurement of retained helium and tritium in irradiated lithium ceramics.** Baldwin, D.L. (Hanford Engineering Development Lab., Richland, WA (USA)). Sep 1983. Contract AC06-76FF02170. 3p. (CONF-830942—71). NTIS, PC A02/MF A01. Order Number DE84003951.

From 3. topical meeting on fusion reactor materials; Albuquerque, NM, USA (19 Sep 1983).

The method, performed on a single sample for both gases, consists of dissolution within a closed system, followed by a combination of mass spectrometry and liquid scintillation counting. The four-step process is designed to keep all contamination and exposure inside the shielded cell. The in-cell apparatus is an all-pyrex and stainless steel dissolution and cold trap assembly. Stainless steel vacuum-tight fittings with rubber O-rings are used to connect the various pieces. A mercury toepler pump is used for quantitative transfer of the released gases from the in-cell apparatus to a sampling cylinder out-of-cell.

9148 (HEDL-SA—2923) **Stability of the FMIT high speed, free surface liquid jet flowing along a curved wall.** Hassberger, J.A. (Hanford Engineering Development Lab., Richland, WA (USA)). Oct 1983. Contract AC06-76FF02170. 6p. (CONF-831203—40). NTIS, PC A02/MF A01. Order Number DE84003856.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

Measurements of surface wavelengths observed on the surface of curved wall, free surface liquid jets are presented. Tests were performed in both liquid lithium and water in a Reynold's number range from 200 to 400, based on the surface speed and boundary layer displacement thickness. Results are found to compare favorably with observations of free surface flows in both submerged cavities and cylindrical jets. An effect of surface tension is observed from these results.

9149 (HEDL-SA—2999-FP) **Fusion Materials Irradiation Test (FMIT) Facility.** Hagan, J.W.; Opperman, E.K.; Trego, A.L. (Hanford Engineering Development Lab., Richland, WA (USA)). Sep 1983. Contract AC06-76FF02170. 8p. (CONF-830942—75). NTIS, PC A02/MF A01. Order Number DE84004823.

From 3. topical meeting on fusion reactor materials; Albuquerque, NM, USA (19 Sep 1983).

The Fusion Materials Irradiation Test (FMIT) Facility will fulfill a key role in the development of fusion power systems. The need for materials irradiation technology for neutron energies and fluences which are uniquely achievable in FMIT has been confirmed through international review. The facility design and supportive R and D base establish significant confidence that the facility will fulfill its specified materials research and development function.

9150 (JAERI-M—82-066) Computer code for computing the beam profiles in the NBI beam line 'BEMPROF'. Ohara, Yoshihiro; Kuriyama, Masaaki. (Japan Atomic Energy Research Inst., Tokyo). Jul 1982. 71p. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE83704200.

A computer code was developed which can compute the beam profiles and the percentage heat loadings on the various components in the NBI beam line such as the beam target, the beam limiters and the calorimeter. The geometrical injection efficiency of NBI and the heat input pattern on the counter surface of the injection port of the torus can also be computed. The major feature of this code is that the effects of the beamlet intensity distribution, the beamlet deflection, the beam screening by the upstream limiters and also the plasma density distribution and the divergence angle distribution over the beam extraction area can be taken into account.

9151 (LA—9892-MS) Anomalous resistivity at the field null of the FRC: a quasi-linear expression based upon flute-type modes. Gerwin, R. (Los Alamos National Lab., NM (USA)). Oct 1983. Contract W-7405-ENG-36. 14p. NTIS, PC A02/MF A01. Order Number DE84003556.

In the Field-Reversed Theta Pinch (FRC) experiment, the poloidal flux is observed to be lost at a rate several times greater than classical resistivity would allow. Thus, there must be anomalous resistivity at the field null. Assuming that an electromagnetic microinstability of the flute mode type is responsible for this, we derived a general expression for the anomalous resistivity at the field null based upon a quasi-linear model of the microturbulence. This general expression does not depend upon the details of the ion-species model, for example, whether the ions are fluid or kinetic.

9152 (LA-UR—83-3229) Tritium and plutonium production as a step toward ICF commercialization. Pendergrass, J.H.; Dudziak, D.J. (Los Alamos National Lab., NM (USA)). 1983. Contract W-7405-ENG-36. 6p. (CONF-8311127—1). NTIS, PC A02/MF A01. Order Number DE84003778.

From IASTED energy symposium; Orlando, FL, USA (9 Nov 1983).

The feasibility of a combined special nuclear materials (SNM) production plant/engineering test facility (ETF) with reduced pellet and driver performance requirements as a step toward commercialization of inertial confinement fusion (ICF) is examined. Blanket design and tritium production cost studies, the status of R & D programs, and the ETF role are emphasized.

9153 (LBL—16866) Formation of negative ions by charge transfer: He^- to Cl^-. Schlachter, A.S. (Lawrence Berkeley Lab., CA (USA)). Oct 1983. Contract AC03-76SF00098. 13p. (CONF-831180—12). NTIS, PC A02/MF A01. Order Number DE84004324.

From 3. international symposium on the production and neutralization of negative ions and beams; Upton, NY, USA (14 Nov 1983).

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Formation of energetic beams of negative ions of elements with atomic numbers 2 to 17 (helium to chlorine) by charge transfer in metal vapors is discussed.

9154 (LBL—16871) Volume H^- ion production experiments at LBL. Leung, K.N.; Ehlers, K.W. (Lawrence Berkeley Lab., CA (USA)). Nov 1983. Contract AC03-76SF00098. 14p. (CONF-831180—11). NTIS, PC A02/MF A01. Order Number DE84004342.

From 3. international symposium on the production and neutralization of negative ions and beams; Upton, NY, USA (14 Nov 1983).

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H^- ions formed by volume processes have been extracted from a multicusp ion source. It is shown that a permanent magnet filter together with a small positive bias voltage on the plasma grid can produce a very significant reduction in electron drain as well as a sizable increase in H^- ions available for extraction. A further reduction in electron current is achieved by installing a pair of small magnets at the extraction aperture. An H^- ion current density of 38 mA/cm^2 was obtained with a discharge current of approximately 350 A. Different techniques to increase the H^- ion yield have also been investigated.

9155 (NBSIR—83-1690) Materials studies for magnetic fusion energy applications at low temperatures - VI. Reed, R.P.; Simon, N.J. (eds.). (National Bureau of Standards, Boulder, CO (USA). Fracture and Deformation Div.). May 1983. 435p. NTIS, PC A19/MF A01. Order Number DE83017361.

Separate abstracts were prepared for 21 of the included sections. (MOW)

9156 (NRL-MR—5219) Status of light ion inertial fusion research at NRL. Cooperstein, G.; Ottinger, P.F.; Goldstein, S.A.; Barker, R.J.; Colombant, D.G.; Meger, R.A.; Neri, J.M.; Mosher, D.; Sandel, F.L.; Stephanakis, S.J.; Young, F.C. (Naval Research Lab., Washington, DC (USA); JAYCOR, Alexandria, VA (USA); Mission Research Corp., Alexandria, VA (USA)). 30 Nov 1983. Contract AI08-79DP40092. 27p. (CONF-821089—15). NTIS, PC A03/MF A01. Order Number DE84004027.

From 6. international workshop on laser interaction and related plasma phenomena; Monterey, CA, USA (25 Oct 1982).

High-brightness proton beams have recently been extracted from axial pinch-reflex diodes mounted on the NRL Gamble II generator. The source power brightness that was measured exceeded 10 TW/cm^2rad^2. Analysis of a modular ICF system using such diodes shows that an operational window for transport of light-ion species exists. Multi-terawatt beams can be transported a few meters in channels a few centimeters in diameter. A proof-of-principle experiment for the required final focusing cell has been successfully carried out on Gamble II. A new barrel-shaped equatorial PRD that can be coupled to PBFA II as a single diode has also been operated on Gamble II and has demonstrated 50% ion efficiency with predominately azimuthally-symmetric charged-particle flow. Preliminary experiments using vacuum inductive storage and plasma opening switches have demonstrated factor-of-three pulse compressions, with corresponding power and voltage multiplications for pulse durations of interest to PBFA II. In other experiments the stopping power of deuterons in hot plasmas was measured. Results show about 40% enhancement in stopping power over that in cold targets when the deutron beam is focused on the target to about 0.25 MA/cm^2.

9157 (ORNL—5919) Fusion Energy Division annual progress report, period ending December 31, 1982. (Oak Ridge National Lab., TN (USA)). Nov 1983. Contract W-7405-ENG-26. 328p. NTIS, PC A15/MF A01. Order Number DE84003152.

Separate abstracts were prepared for 10 of the included sections. (MOW)

9158 (ORNL—5919, pp 1-30) EBT research and development. Nov 1983. NTIS, PC A15/MF A01.

In Fusion Energy Division annual progress report, period ending December 31, 1982.

Exploration and development of the ELMO Bumpy Torus (EBT) magnetic confinement concept continued on the EBT device in both its initial (EBT-I) and scaled (EBT-S) configurations and through the EBT Proof-of-Principle (EBT-P) project. Investigations of confinement physics on the EBT-S facility and progress in Title II design of the EBT-P device were major areas of activity during 1982.

9159 (ORNL—5919, pp 31-79) Toroidal confinement experiments. Nov 1983. NTIS, PC A15/MF A01.

In Fusion Energy Division annual progress report, period ending December 31, 1982.

Systematic confinement scans on the Impurity Study Experiment (ISX-B) during 1982 confirmed the previous scaling, tau/sub E/ proportional to I/sup p/sup 3/2/P/sub b/sup -2/3/. Experiments show no evidence of deteriorating fast ion confinement with increasing beam power P/sub b/, thus confirming that the nonlin-

ear response of volume-averaged beta to P/sub b/ is due to deteriorating electron energy confinement. Power balance analyses consistently show the deterioration to be primarily the result of electron thermal conductivity chi/sub e/ increasing with P/sub b/ (or, equivalently, poloidal beta β/sub p/), although particle, momentum, and ion energy confinement also deteriorate with P/sub b/. Experimental determinations of chi/sub e/ from power balance and from outside sawtooth propagation agree closely at high β/sub p/ with the Carreras-Diamond expression of chi/sub e/ due to the transport effects of resistive ballooning modes, which are theoretically predicted for these plasmas. The Advanced Toroidal Facility (ATF-1) is intended to study high beta, low collisionality plasmas in a current-free stellarator configuration with sufficient flexibility to examine a wide range of magnetic configurations. Details are given of the device selection procedure, the properties of the configuration, the engineering design, and the intended physics program.

9160 (ORNL—5919, pp 171-192) **Plasma technology.** Nov 1983. NTIS, PC A15/MF A01.

In Fusion Energy Division annual progress report, period ending December 31, 1982.

This section reviews work on the following areas: (1) neutral beam injector; (2) neutral beam applications and operations; (3) pellet fueling; (4) rf heating; and (5) gyrotron development program. (MOW)

9161 (ORNL—5919, pp 193-212) **Superconducting magnet development.** Nov 1983. NTIS, PC A15/MF A01.

In Fusion Energy Division annual progress report, period ending December 31, 1982.

The Large Coil Program (LCP) continued to manage the design and manufacture by US firms of three superconducting magnet coils that will be tested and evaluated in the Large Coil Test Facility (LCTF) now under construction at ORNL. During 1982, General Dynamics Convair Division finished winding its coil and began final assembly. General Electric Company finished winding its coil and delivered the coil to Oak Ridge for final assembly. Conductor production and coil plate machining for the Westinghouse Electric Corporation (Westinghouse) coil progressed; Westinghouse installed two winding lines and completed its first double pancake. The international Large Coil Task (LCT), for which ORNL acts as the operating agent, continued its progress during 1982. The Japanese coil was successfully tested in Japan and delivered to ORNL. Siemens finished winding the Euratom coil and Krupp finished the coil case. Brown-Boveri finished the case for the Swiss coil, began production of the conductor, and initiated winding. Work by the Magnetics and Superconductivity Section included notable progress in four areas: research and development activities in support of the LCP, the 12-T coil project, advanced conductor development, and testing of toroidal field coils for the ELMO Bumpy Torus Proof-of-Principle Project.

9162 (ORNL—5919, pp 213-240) **Advanced system studies.** Nov 1983. NTIS, PC A15/MF A01.

In Fusion Energy Division annual progress report, period ending December 31, 1982.

During 1982, the Design Center progressed toward its goal of defining the next step in the national magnetic fusion program as the FED Baseline studies continued with increased emphasis on improved performance and lower cost. As a major participant in the US INTOR activity, the Design Center has had the primary responsibility for development of the mechanical configuration and has supported the cost studies. In addition, development was carried out on an advanced tokamak option employing high leverage, advanced physics (FED-A), a tokamak with resistive toroidal field coils that would produce an intense source of neutrons (FED-R), and a mirror-based Technology Demonstration Facility. The Design Center also provided support to the Princeton Plasma Physics Laboratory and the Lawrence Livermore National Laboratory in defining potential upgrades for the Tokamak Fusion Test Reactor and the Mirror Fusion Test Facility.

9163 (ORNL—5919, pp 241-254) **Radiation materials testing.** Nov 1983. NTIS, PC A15/MF A01.

In Fusion Energy Division annual progress report, period ending December 31, 1982.

The objective of the Fusion Materials Program at ORNL is to develop materials for both near-term and commercial fusion reactors. The 14-MeV neutrons produced in the latter result in unique irradiation damage because of the high defect generation rate and the simultaneous production of high concentrations of helium and hydrogen. Although no fusion test reactor exists, the effects of combined displacement damage plus helium can be and are being studied in two mixed-spectrum fission reactors, the High Flux Isotope Reactor (HFIR) and the Oak Ridge Research Reactor (ORR). Extensive tests are under way in HFIR and ORR on austenitic stainless steels and ferritic steels. In ORR, spectral tailoring is used to produce the correct helium/displacements per atom (He/dpa) ratio for the austenitics.

9164 (ORNL—5919, pp 255-261) **Neutron transport.** Nov 1983. NTIS, PC A15/MF A01.

In Fusion Energy Division annual progress report, period ending December 31, 1982.

The neutron transport program includes both experimental and analytic phases. The experimental program is designed to provide the data necessary for verifying the analytic method and cross-section data used for fusion reactor neutronics design calculations. Experiments are being carried out to determine the neutron and photon transport in typical fusion reactor shield materials and configurations and to determine the effects of penetrations in these shields. The analytic program supports the design of the in thegral experiments and compares calculated data with data obtained experimentally. Neutronics calculations were also carried out in support of the Fusion Energy Radiation Damage Program, the ELMO Bumpy Torus Proof-of-Principle project, the Tokamak Fusion Test Reactor, and the Engineering Test Facility design. Work was also performed inte area of data evaluation and cross-section processing, and the Radiation Shielding Information Center has continued to supply a broad range of services to the fusion energy research community.

9165 (UCID—19853) **Ultra-high-field superconducting magnets.** Hoard, R.W.; Cornish, D.N.; Scanlan, R.M.; Zbasnik, J.P.; Leber, R.L.; Hickman, R.B.; Lee, J.D. (Lawrence Livermore National Lab., CA (USA)). Aug 1983. Contract W-7405-ENG-48. 47p. NTIS, PC A03/MF A01. Order Number DE84003913.

The following topics are considered: (1) superfluid helium for advanced magnets, (2) conductor reinforcement, (3) designing a 20-T, 2-m bore solenoidal coil, (4) coil size and conductor properties, (5) axial forces on the coil, (6) effect of radiation on the coil systems, and (7) helium-II transient heat transfer and coil protection. (MOW)

9166 (UCRL—50051-83-1) **Mirror fusion quarterly report, January-March 1983.** (Lawrence Livermore National Lab., CA (USA)). 27 Jun 1983. Contract W-7405-ENG-48. 64p. NTIS, PC A04/MF A01. Order Number DE84002687.

The main sections of this report are (1) Applied Plasma Physics, (2) Mirror Fusion Test Facility, (3) Confinement Systems, and (4) Development and Technology. Each main section is introduced by an overall statement of the goals and objectives. Summaries of the purposes of individual programs and projects are followed by articles concerning significant recent activities. In most cases the individual report is preceded by a very brief summay statement.

9167 (UCRL—89232) **Magnet power control system for the Tandem Mirror Experiment-Upgrade.** Bell, H.H. Jr. (Lawrence Livermore National Lab., CA (USA)). 4 Nov 1983. Contract W-7405-ENG-48. 6p. (CONF-831203—28). NTIS, PC A02/MF A01. Order Number DE84003737.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

This paper describes the desktop computer/CAMAC-based system that controls the power source for the Tandem Mirror Experiment-Upgrade (TMX-U) magnet power system. Presently it contains 42 dc rectifier power supplies connected to 24 magnet coils arranged in 17 circuits. During each shot, the system delivers 22.6 MW dc to the magnets for about 3 s. The system is presently

being changed to add six power supplies, two solenoidal throttle coils, and two reverse C-coils. When complete, the delivered power will increase to 36.9 MW. The closed-loop control system usually provides current (and thus, magnetic field) that is within 1% of the requested current. Achieving this accuracy required using grounding, shielding, and isolation methods to reduce noise and related problems. These are also discussed.

9168 **(UCRL—89321) Magnetic shielding tests for MFTF-B neutral beamlines.** Kerns, J.; Fabyan, J.; Wood, R.; Koger, P. (Lawrence Livermore National Lab., CA (USA)). 16 Nov 1983. Contract W-7405-ENG-48. 7p. (CONF-831203—19). NTIS, PC A02/MF A01. Order Number DE84003734.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

A test program to determine the effectiveness of various magnetic shielding designs for MFTF-B beamlines was established at Lawrence Livermore National Laboratory (LLNL). The proposed one-tenth-scale shielding-design models were tested in a uniform field produced by a Helmholtz coil pair. A similar technique was used for the MFTF source-injector assemblies, and the model test results were confirmed during the Technology Demonstration in 1982. The results of these tests on shielding designs for MFTF-B had an impact on the beamline design for MFTF-B. The iron-core magnet and finger assembly originally proposed were replaced by a simple, air-core, race-track-coil, bending magnet. Only the source injector needs to be magnetically shielded from the fields of approximately 400 gauss.

9169 **(UCRL—89370) Mirror Advanced Reactor Study (MARS) final report summary.** Henning, C.D.; Logan, B.G.; Carlson, G.A.; Perkins, L.J.; Werner, R.W.; Gordon, J.D.; Parmer, J.F.; Bilton, J.R.; Glancy, J.E.; Kulcinski, G.L. (Lawrence Livermore National Lab., CA (USA)). 8 Dec 1983. Contract W-7405-ENG-48. 9p. (CONF-831203—38). NTIS, PC A02/MF A01. Order Number DE84004851.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

The Mirror Advanced Reactor Study (MARS) has resulted in an overview of a first-generation tandem mirror reactor. The central cell fusion plasma is self-sustained by alpha heating (ignition), while electron-cyclotron resonance heating and negative ion beams maintain the electrostatic confining potentials in the end plugs. Plug injection power is reduced by the use of high-field choke coils and thermal barriers, concepts to be tested in the Tandem Mirror Experiment-Upgrade (TMX-U) and Mirror Fusion Test Facility (MFTF-B) at Lawrence Livermore National Laboratory.

9170 **(UCRL—89979) Application of He-II technology to the production of ultrahigh-field superconducting magnets.** Hoard, R.W. (Lawrence Livermore National Lab., CA (USA)). Nov 1983. Contract W-7405-ENG-48. 8p. (CONF-831203—37). NTIS, PC A02/MF A01. Order Number DE84004853.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

Data and operating experience acquired during the last three years on the heat-transfer properties of pressurized superfluid He II indicate that the fluid can be successfully used as a coil coolant for high-field superconducting magnets. Indeed, the fluid seems to offer triple benefits over that of ordinary normal life: (1) coil conductors can be driven to wetted perimeter heat fluxes exceeding 1 $W.cm^{-2}$; (2) the reduced low-temperature operation (from 4.2) at 1.8 K enhances the critical current densities (J/sub c/) of both Nb_3Sn and ternary additions to the compound by 140 to 200%; (3) the upper critical field (H/sub c2/) also increases, allowing viable solenoid magnet designs approaching 20-T peak fields. This paper reviews the significant properties of He II relevant to magnet design, describes current superconducting coils and systems that utilize the fluid, and discusses the possible application of the present data base to production of future ultrahigh-field superconducting coils yielding 20-T fields.

9171 **(UCRL—90008) Mirror research: status and prospects.** Baldwin, D.E. (Lawrence Livermore National Lab., CA (USA)). 29 Nov 1983. Contract W-7405-ENG-48. 19p. (CONF-831203—30). NTIS, PC A02/MF A01. Order Number DE84003747.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

The tandem mirror program has evolved considerably in the last decade. Of significance is the viable reactor concept embodied in the MARS design. An aggressive experimental program culminating in the operation of MFTF-B in late 1986, will provide a firm basis for refining the MARS design as necessary for constructing a reactor prototype in the 1990s.

9172 **(UCRL—90058) Tritium related safety considerations for mirror upgrades.** Ghose, S.K. (Bechtel Group, Inc., San Francisco, CA (USA); Lawrence Livermore National Lab., CA (USA)). 30 Nov 1983. Contract W-7405-ENG-48. 7p. (CONF-831203—36). NTIS, PC A02/MF A01. Order Number DE84003647.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

One of the primary objectives of the MFTF-B upgrades is to demonstrate the technology of tritium breeding in a reactor-like configuration. This requires use and processing of tritium, involving an inventory of several hundred grams at the plant. This paper reviews the results of a preliminary assessment of the radiation hazard associated with the handling of tritium. The radiation dose consequences due to tritium release from normal operation and due to postulated accidents on plant personnel and the public were assessed. Maximum credible (probability $< 10^{-3}$, but $> 10^{-7}$/yr) accidental releases were estimated to be 10 gm in the reactor building and 100 gm in the tritium-processing building. Higher probability ($> 10^{-3}$/yr) accidents or component failures would result in much smaller releases. In the reactor building, the most severe accident would result from the rupture of a plasma exhaust duct from the end cell or the tritium feed pipe to the neutral beam injector, accompanied by a fire. In the tritium processing building, the most severe accident would be the rupture of the Isotope Separation System (ISS) distillation columns and vacuum jackets accompanied by a fire.

9173 **Radial electron beam autoaccelerator for inertial confinement fusion.** Poukey, J.W.; VanDevender, J.P.; Quintenz, J.P.; Lockner, T.R. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Journal of Applied Physics;* 55: No. 1, 138-149(1 Jan 1984). Contract AC04-76DP00789.

A possible approach to particle-beam fusion is to use a series of electron-beam driven coaxial cavities as an autoaccelerator to produce a short, high-energy electron pulse which in turn drives an ion diode. A theoretical study of such a system is made, using an electromagnetic particle code, and an equivalent circuit model for the whole system. The particle simulations indicate that a beam-to-wave conversion efficiency of up to 70% is possible for a single cavity, with careful design. Circuit modeling studies suggest that this implies an overall system efficiency which is somewhat low for reactor applications, but of possible interest for single pulse laboratory experiments.

9174 **Construction of three-dimensional vacuum magnetic fields with dense nested flux surfaces.** Cary, J.R. (Institute for Fusion Studies, University of Texas, Austin, Texas 78712). *Physics of Fluids;* 27: No. 1, 119-128(Jan 1984). Contract FG05-80ET53088.

Toroidal vacuum magnetic fields are analyzed by the surface of section technique and noncanonical perturbation theory. The surface of section analysis shows that it is easy to find magnetic fields with an outermost flux surface of relatively small aspect ratio. However, as the aspect ratio is decreased, so is the rotational transform of the outermost flux surface. A new method of averaging combined with noncanonical perturbation theory shows that island overlap can account roughly for this loss of rotational transform. Finally, it is shown that one can significantly decrease the stochasticity and island structure by making small modifications to the magnetic field.

9175 **Multi-megawatt neutral beams for MFTF-B.** Kerr, R.G. (Lawrence Livermore Natl. Lab., P.O.B. 808, Livermore, CA 94550). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* 30: No. 2, 1197-1200(Apr 1983). Contract W-7405-ENG-48.

The Mirror Fusion Test Facility (MFTF-B) at Lawrence Livermore National Laboratory is a reactor-scale tandem-mirror experiment that will provide physics and technology bases for a D-T burning, tandem-mirror facility in the 1990's.

9176 **TMX upgrade magnet system: design characteristics and physics considerations.** Foote, J.H.; Chargin, A.K.; Cohen, R.H.; Kaiser, T.B.; Karmendy, C.V.; Simonen, T.C.; Wong, R.L. (Lawrence Livermore National Laboratory, Univ. of California, Livermore, California 94550). *Journal of Fusion Energy;* 2: No. 6, 383-402(Dec 1982). Contract W-7405-ENG-48.

Summarized in this article are the design characteristics of the magnet-system configuration constructed for use in the modified Tandem Mirror Experiment (TMX Upgrade), and a description of the resulting vacuum magnetic field. Many engineering and physics considerations and limitations governed the design. Several of the physics issues are discussed here, including single-particle drift surfaces and adiabaticity, central-cell resonant radial transport, magnetohydrodynamic stability analysis, and finite-beta equilibrium. The described design procedures can be applied to other tandem-mirror experiments or reactor studies.

9177 **The impact of ripple on the design of advanced fuel tokamaks.** Bhadra, D.K.; Petrie, T.W.; Rawls, J.M. (General Atomic Company, San Diego, California). *Journal of Fusion Energy;* 2: No. 6, 435-437(Dec 1982). Contract AT03-76ET51011.

Enhanced ion transport due to toroidal field ripple is a concern in the design of tokamak power reactors. This concern is quantified for advanced fuel cycle applications where the simultaneous requirement of high /eta//tau/ and high T makes the constraint on deviation from axisymmetry especially severe.

9178 **Magnetic ripple diffusion and stable INTOR equilibria.** Petrie, T.W.; Bhadra, D.K.; Helton, F.J.; Rawls, J.M. (General Atomic Company, P.O. Box 81608, San Diego, California 92138). *Journal of Fusion Energy;* 2: No. 2, 113-122(Apr 1982). Contract AT03-76ET51011.

Under conditions representative of ignited tokamak operation, ion energy losses are likely to be dominated by transport due to deviation from toroidal field axisymmetry. This asymmetry, termed ripple, induces several distinct physical processes, all of which lead to enhanced ion thermal conduction above the neoclassical value. The net impact of these processes on ignition dynamics is analyzed for an INTOR-like plasma by means of a 1 1/2-D transport code. The radial shift of the plasma to regions of higher ripple during plasma heating results in a substantial broadening of the "window" of values of ripple consistent with favorable ignition and burn characteristics and also provides some measure of automatic burn control. Because β-limiting processes are also prime candidates for burn control, the profiles obtained from the transport analyses are examined for stability with respect to ideal MHD modes. The MHD-limited β value increases as the plasma is heated and in fact in the burn phase approaches the value characteristic of a shape-optimized MHD equilibrium. The sensitivity of the transport and MHD results to the choice of plasma density is examined, and it is found that hot-ion mode operation is precluded for devices such as INTOR unless present estimates of both ripple losses and β-limits are highly pessimistic.

9179 **Equilibrium evolution on the resistive time scale in a tokamak reactor.** Holmes, J.A.; Peng, Y.K.M.; Rothe, K.E. (Computer Sciences Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). *Journal of Fusion Energy;* 2: No. 2, 123-130(Apr 1982). Contract W-7405-ENG-26.

In the Engineering Test Facility (ETF), the plasma pulse duration is expected to be hundreds of seconds, which is comparable to the resistive time scale that governs the resistive diffusion of the equilibrium. The resistive evolution of the safety factor q profile may, for MHD stability reasons, limit the duration of the plasma burn in a tokamak reactor. It may be possible to control this evolution and extend the plasma burn time through proper profile tailoring. We study the evolution of the q profile on the resistive time scale numerically using a one-and-one-half-dimensional (1 1/2-D) single fluid transport code. Two high beta (B/TAU/ about 7-16%) cases are considered: (a) a beam-driven hydrogen plasma with no nuclear alpha heating for which the beam energy is used as a device to control the temperature profile, and (b) an ignited D-T plasma in which the neutral injection has been turned off. For the beam-driven plasma, it is shown that low beam energy heating profiles lead to resistive steady states having broad temperature profiles and flat q profiles, while high beam energy heating profiles lead to resistive steady states having peaked temperature profiles and deep q profiles. The centralized nuclear heating in an ignited D-T plasma causes the evolution of the q profile for this case to behave much like that in the high energy, beam-driven case: namely, the q values near the plasma center decrease on the resistive time scale until a deep, resistive, steady-state q profile is reached.

9180 **A performance comparison of lithium, helium, and flibe cooled tube/header fusion blankets.** Chao, J.; Gierszewski, P.; McManamy, T.J.; Mikic, B.B.; Todreas, N.E. (Electric Power Research Institute, Nuclear Safety Analysis Center, Palo Alto, California 94303). *Journal of Fusion Energy;* 2: No. 2, 145-159(Apr 1982).

The objective of this study is to provide a comparison of thermal-hydraulic and structural performance of lithium, helium, and flibe cooled fusion blankets based on a tube/header geometry in a liquid lithium breeder. Type 316 stainless steel and TZM are considered as representative near-term and long-term, high temperature blanket structural materials, respectively, to show the potentials of each coolant. The flibe-TZM system has the best characteristics, while lithium-316SS, helium-316SS, and helium-TZM are comparable but definitely more limited in operating conditions. These results suggest that molten salt-refractory metal systems deserve more attention.

9181 **Monte Carlo simulation of molecular flow in a neutral beam injector and comparison with experiment.** Lillie, R.A.; Alsmiller, R.G. Jr.; Gabriel, T.A.; Santoro, R.T.; Schwenterly, S.W. (Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). *Journal of Fusion Energy;* 2: No. 2, 161-172(Apr 1982). Contract W-7405-ENG-26.

Monte Carlo calculations have been performed to obtain estimates of the background gas pressure and molecular number density as a function of position in the PDX-prototype neutral beam injector, which has undergone testing at the Oak Ridge National Laboratory. Estimates of these quantities together with the transient and steady-state energy deposition and molecular capture rates on the cryopanels of the cryocondensation pumps and the molecular escape rate from the injector were obtained utilizing a detailed geometric model of the neutral beam injector. The molecular flow calculations were performed using an existing Monte Carlo radiation transport code, which was modified slightly to monitor the energy of the background gas molecules. The credibility of these calculations is demonstrated by the excellent agreement between the calculated and experimentally measured background gas pressure in front of the beamline calorimeter located in the downstream drift region of the injector. The usefulness of the calculational method as a design tool is illustrated by a comparison of the integrated beamline molecular density over the drift region of the injector for three modes of cryopump operation.

9182 **Dose rates from the inducted activity in the ETF neutral beam injector.** Santoro, R.T.; Alsmiller, R.G. Jr.; Barnes, J.M.; Lillie, R.A. (Oak Ridge National Laboratory, Oak Ridge, TN 37830). *Journal of Fusion Energy;* 2: No. 2, 173-178(Apr 1982). Contract W-7405-ENG-26.

The dose equivalent rates outside the Engineering Test Facility neutral beam injector shield from the induced radioactivity have been calculated for the reactor operating at 1140 MW for 1, 30, and 365 days. The dose rates at one day after shutdown are large even after one day of operation. Depending on the location

and operating time, cooling times from 30 days to about 5 years are required before the dose rates are sufficiently low to allow routine maintenance work in the vicinity of the NBI shield.

9183 **Particle ring fusion.** Sudan, R.N. (Laboratory of Plasma Studies, Cornell University, Ithaca, New York 14853). pp 311-329 of Unconventional approaches to fusion. Brunelli, B. New York, NY; Plenum Pub. Corp. (1982). (CONF-810364—).

From International school of fusion reactor technology's course on unconventional approaches to fusion; Erice, Italy (16 Mar 1981).

The "particle ring" or more precisely the "ion ring" approach to fusion is unconventional only in that at present few laboratories are involved in this endeavor, but the concept itself evolved from the ASTRON which originated in the early fifties along with most of the other basic magnetic fusion reactor concepts. The ASTRON is the first concept to emphasize the advantages the a system with a region of closed field lines produced by internal currents surrounding by a region of open field lines. As compared to tokamaks, the main advantages amount to: simple solenoidal magnet system; high β plasma; natural divertor action of open field lines; no auxiliary heating; pulsed and steady state reactor scenarios; and small unit size in the range of 500 MW. This paper discusses ring equilibria (flux surfaces of ion ring generated by RINGA code; exponential rigid rotor distribution for ions; poloidal flux, magnetic field, plasma pressure, and current density at midplane as a function of normalized radius for equilibria), basic energy balance for fusion power output (included is a power flow diagram for an ion ring fusion system), magnetic compression of rings (included is a schematic of injection, trapping, compression, and burn regions of hybrid-ring system), and injection and formation of rings.

9184 **The linus concept.** Robson, A.E. (Naval Research Laboratory, Washington, DC 20375). pp 257-279 of Unconventional approaches to fusion. Brunelli, B. New York, NY; Plenum Pub. Corp. (1982). (CONF-810364—).

From International school of fusion reactor technology's course on unconventional approaches to fusion; Erice, Italy (16 Mar 1981).

This paper describes an unconventional approach to fusion in which the principal operations on the plasma, namely heating it to fusion temperature and extracting the /CHI/-particle energy, are performed mechanically by means of a rotationally-stabilized liquid lithium liner. This concept may properly be described as a fusion engine, except there is no shaft output; all the fusion energy appears in the liner as heat. Although the plasma is magnetically confined there are no external magnet coils; the method of plasma production by electron beams also creates the confining magnetic fields which are maintained by induced currents in the plasma and on the liner surface. Apart from the obvious economy of eliminating superconducting coils, this also allows the reactor to be built from ferritic steel. The basic simplicity of the Linus concept is due to the combination in one element, the liner, of functions which in other fusion concepts require separate systems. It is the confining field coil, the plasma heater, the first wall, the tritium breeding blanket, the heat transfer medium and the main vacuum pump. Perhaps its most important function is that of providing a continuously regenerated liquid first wall whose mean power loading can greatly exceed the limits of a solid first wall.

9185 **The spheromak.** Okabayashi, M. (Plasma Physics Laboratory, Princeton University, Princeton, New Jersey 08544). pp 95-134 of Unconventional approaches to fusion. Brunelli, B. New York, NY; Plenum Pub. Corp. (1982). (CONF-810364—). Contract AC02-76CH03073.

From International school of fusion reactor technology's course on unconventional approaches to fusion; Erice, Italy (16 Mar 1981).

In view of the recent rapid progress of toroidal confinement devices towards a break-even plasma state, a serious question arises as to whether the present tokamak approach will indeed reach the final goal of a commercially feasible nuclear fusion reactor. Experimental studies of a high electron temperature, long pulse, spheromak plasma will explore an alternative to the tokamak approach, and will examine toroidal plasma confinement properties in a completely different magnetic field configuration, one with strong magnetic shear and no minimum average B as opposed to the modest shear, minimum B tokamaks. In this sense, spheromak research is complimentary to tokamak research and will improve our understanding of plasma physics in toroidal devices, as the overall optimization of toroidal devices will only be accomplished through the integration of the best of the various approaches. The authors discuss (1) the theoretical analysis of the spheromak, (recent theoretical studies are summarized and a comparison is made with other approaches), and (2) a spheromak plasma formation scheme. One of the difficult aspects of spheromak research is to produce a toroidal plasma in the absence of coils down the axis of rotational symmetry. A novel plasma formation scheme has been developed at PPPL to create a toroidal plasma by using a flux generating core technique. This formation scheme has been optimized with the assistance of resistive MHD computer codes. The parameters of the S-1 device, now under construction, were determined with various theoretical aids. Recently a small device (1/6 scale of S-1) has successfully produced a spheromak plasma using this scheme.

9186 **Fusion reactor aspects of the compact torus.** Hartman, C.W. (Lawrence Livermore National Laboratory, University of California, Livermore, California 94550). pp 73-93 of Unconventional approaches to fusion. Brunelli, B. New York, NY; Plenum Pub. Corp. (1982). (CONF-810364—). Contract W-7405-ENG-48.

From International school of fusion reactor technology's course on unconventional approaches to fusion; Erice, Italy (16 Mar 1981).

This paper summarizes several studies of fusion reactors based on the compact torus (CT). A wide variety of reactor configurations can be projected within present understanding of the possible types of CT and their macroscopic stability and confinement properties. Three types of CT are considered here, the field-reversed-configuration having/SUP B/ Toroidal = 0, the Spheromak with B /SUB T/ not = 0, and CT's formed with particle rings. For each type, either fixed or moving-ring possibilities are offered along with pulsed or steady operation. In all cases the CT configuration lends itself to simplified blanket and coil design. In certain, important cases a reactor-scale CT is predicted to produce small unit power (10-100 MW/SUB e/) facilitating small-scale pilot plants and eventual modularity.

9187 **Thermoviscoplastic analysis of first walls subjected to fusion power transients.** Schreyer, H.L. (Department of Mechanical Engineering, University of New Mexico, Albuquerque, New Mexico). *American Society of Mechanical Engineers, [Paper]*; No. 82-PVP-66, 11(1982). (CONF-820601—).

From ASME pressure vessel and piping conference; Orlando, FL, USA (27 Jun 1982).

Abrupt thermal fluxes on the first walls of fusion reactors represent a loading environment that requires advanced analytical capabilities. Solutions are needed to a wide range of postulated conditions to provide guidance for safety features and design modifications. A brief outline is given of a computer code that provides an integrated procedure for handling thermal stresses and large deformations under dynamic conditions. The code includes a new thermoviscoplastic constitutive equation that incorporates thermal softening, failure and strain rate. Solutions to several verification and illustrative problems are given.

99 GENERAL AND MISCELLANEOUS

9901 Management

REFER ALSO TO CITATION(S) 8743, 9216

9188 **(DOE/ER—0181) Abstracts of Phase I awards, 1983. Small Business Innovation Research program.** (Department of Energy, Washington, DC (USA). Office of Energy Research). Dec 1983. 52p. NTIS, PC A04/MF A01. Order Number DE84004265.

The Department of Energy (DOE) issued its first solicitation for the Small Business Innovation Research (SBIR) program on December 15, 1982, with a due date of March 1, 1983. Out of the 1734 proposals received, 106 were selected for Phase I funding totaling about $5 million. All projects selected are now under contract, with a period of performance typically of six months, starting in almost all cases on September 1, 1983. This publication provides abstracts of the projects selected, including brief comments on the potential applications as described by the proposer. Individuals and organizations, including venture capital and larger industrial firms, with an interest in the research described in any of the abstracts are encouraged to contact the respective company directly.

9189 **(LBL-PUB—5102) Lawrence Berkeley Laboratory technology transfer report.** Morris, R.J. (Lawrence Berkeley Lab., CA (USA)). Oct 1983. Contract AC03-76SF00098. 12p. NTIS, PC A02/MF A01. Order Number DE84004960.

Twenty five technology transfers that occurred or were first noted in FY 1983 are listed.

9902 Mathematics And Computers

REFER ALSO TO CITATION(S) 7090, 7107, 7365, 8372, 8437, 9067

9190 **(ANL/MCS-TM—15) Collection of parallel linear equations routines for the Denelcor HEP .** Dongarra, J.J.; Hiromoto, R.E. (Argonne National Lab., IL (USA)). Sep 1983. Contract W-31-109-ENG-38. 26p. NTIS, PC A03/MF A01. Order Number DE84003665.

This note describes the implementation and performance results for a few standard linear algebra routines on the Denelcor HEP computer. The algorithms used here are based on high-level modules which facilitate portability and perform efficiently in a wide range of environments.

9191 **(ANSI/ANS—10.5-1979) American National Standard: guidelines for considering user needs in computer program development.** (American Nuclear Society, La Grange Park, IL). 1979. 12p. American Nuclear Society, 555 North Kensington Avenue, La Grange Park, IL 60525 $12.00.

This standard provides guidelines for accommodating user needs in preparing computer programs for scientific and engineering applications. Adherence to these guidelines will help ensure proper application and simplify the use of the computer program. The intent is to encourage the development of a product that will be easy to apply correctly.

9192 (CEA-N—2349, pp 13) **Introduction to the UNCLE finite element scheme. Part. 4; Contributions - Session 1.** Enderby, J.A. May 1983. NTIS (US Sales Only), MF A01. (CONF-8210221—).

From IAEA specialist meeting on advances in structural analysis for LMFBR applications; Paris, France (11 Oct 1982).

UNCLE is a completely general finite element scheme which provides common input, output, equation solving and other facilities for a familly of finite element codes for linear and nonlinear stress analysis, heat transfer etc. This report describes the concepts on which UNCLE is based and gives a general account of the facilities provided.

9193 **(CONF-830831—3) Factorization using the quadratic sieve algorithm.** Davis, J.A.; Holdridge, D.B. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 11p. NTIS, PC A02/MF A01. Order Number DE84004996.

From CRYPTO '83 conference; Santa Barbara, CA, USA (21 Aug 1983).

Since the cryptosecurity of the RSA two key cryptoalgorithm is no greater than the difficulty of factoring the modulus (product of two secret primes), a code that implements the Quadratic Sieve factorization algorithm on the CRAY I computer has been developed at the Sandia National Laboratories to determine as sharply as possible the current state-of-the-art in factoring. Because all viable attacks on RSA thus far proposed are equivalent to factorization of the modulus, sharper bounds on the computational difficulty of factoring permit improved estimates for the size of RSA parameters needed for given levels of cryptosecurity. Analysis of the Quadratic Sieve indicates that it may be faster than any previously published general purpose algorithm for factoring large integers. The high speed of the CRAY I coupled with the capability of the CRAY to pipeline certain vectorized operations make this algorithm (and code) the front runner in current factoring techniques.

9194 **(CONF-8305146—) Minutes of the May 20, 1983 Software Working Group Meeting at the Stanford Linear Accelerator Center.** (Stanford Linear Accelerator Center, CA (USA)). 1983. Contract AC03-76SF00515. 26p. (SLAC/FSDG—141; SLAC/FSDG—142; SLAC/FSDG—143). NTIS, PC A03/MF A01. Order Number DE83017557.

From SLAC software working group meeting; Stanford, CA, USA (20 May 1983).

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The meeting included a summary of reactions to the Data Acquisition Conference; discussion of recent changes to the Fastbus specifications; progress reports from CERN, SLAC, UIUC, FNAL; and discussions of standard subroutines, the SR handler, interrupt messages, software resource guide, buffered interconnects, and F-codes. (GHT)

9195 **(DOE/CR/10006—T1) Recommendation for improving performance of the BMIS and IPMIS systems.** Leigh, B.; Yack, S. (Caci, Inc.-Federal, Arlington, VA (USA)). 30 May 1979. Contract AC01-79CR10006. 7p. NTIS, PC A02/MF A01. Order Number DE84004725.

The BMIS and IPMIS systems are supported by the data contained in SYSTEM 2000 data bases. Imterviews with the primary EDS-Federal support for BMIS have indicated that delays of up to 45 minutes have been experienced in activating SYSTEM 2000 using TSO CLISTs. Examination of these CLISTs, and the time-stamped audit trail they produce, shows that two-thirds of this time is spent allocating a number of files. These files include those for the data bases, for terminal input and output, and thirteen scratch and sort files used for temporary work space. Each TSO and batch use of SYSTEM 2000 now creates these thirteen files on system WORK disk volumes. The use of these files in the interactive SYSTEM 2000 environment is limited; in many TSO sessions they are not used at all. However, CLISTs intended for general use must ensure that the files have been allocated with sufficient WORK space to support the highest expected use.

9196 **(DOE/CR/10006—T2) SYSTEM 2000 performance monitoring facility (logger): programmer's guide.** Leigh, J.B.; Karhuse, K. (CACI, Inc., Reston, VA (USA)). 28 Sep 1979. Contract AC01-79CR10006. 25p. NTIS, PC A02/MF A01. Order Number DE84004257.

The S2K/PMF System is a productivity and tuning aid which collects and analyzes performance data on SYSTEM 2000 Program Language Interface (PLI) programs and Natural Language commands. It can be used to investigate data base usage and design, batch program operation, sequencing and structuring of application program PLI calls, and problems with SYSTEM 2000 Natural Language.

9197 **(DOE/ER/02383—0099) Software design issues in the implementation of hierarchical, display editors.** Orailoglu, A. (Illinois Univ., Urbana (USA). Dept. of Computer Science). Sep 1983. Contract AC02-76ER02383. 140p. (COO—2383-0099; UIUCDCS-R—83-1139; UILU-ENG—83-1718). NTIS, PC A07/MF A01. Order Number DE84004796.

Thesis.

Language-based editors offer to the user a number of advantages which accrue from their cognizance of the edited language. Foremost among these are the advantages of manipulating and traversing the edited document in terms of the syntactic structures of the document. Also automatic formatting and error-detection capabilities are afforded to the user through syntax-directed editors. We present an interface that affords the user a dual conceptual framework, i.e. both structural and textural. An implementation which allows user-specification and partial specification of grammars is presented. The implementation affords all the simplicity and power

of the textural model of editing, together with all the advantages of a language-cognizant interface in a language-independent fashion. Design questions for such an editor are examined and reported.

9198 **(DOE/TIC—11616) User's manual for the DOE Technical Information Center Integrated Record Input System (IRIS).** Lawrence, J.D.; Hammond, T. (Lawrence Berkeley Lab., CA (USA)). Mar 1983. Contract AC03-76SF00098. 83p. (LBL—15731). NTIS, PC A05/MF A01. Order Number DE83013074.

This report explains how to use the Integrated Record Input System (IRIS) being developed for the DOE Technical Information Center. This document tells how to interact with the various programs in the DOE/TIC Integrated Record Input System (IRIS). Concentration is on specifics of using each program; more general issues are discussed in Report DOE/TIC-11615.

9199 **(EGG-IS—6281-Rev.1) Core graphics users manual. Revision 1.** Little, R.W. (EG and G Idaho, Inc., Idaho Falls (USA)). 15 Nov 1983. Contract AC07-76ID01570. 120p. NTIS, PC A06/MF A01. Order Number DE84004235.

Portions are illegible in microfiche products.

Core Graphics is a general purpose, FORTRAN callable graphics and image display software system, implemented as a FORTRAN subroutine library. Its importance and usefulness arise from its device independence and its transportability, i.e. A program written using Core Graphics may be run on any of several different graphics devices and/or CPU's without modification. Core Graphics has been designed as a comprehensive integrated image and Graphic System wherein the user can manipulate two distinct data types within the same coordinate reference frame. The Core Graphics user can handle both image and Graphic data in the real world sense and in a standard Cartesian coordinate system without concern for the pixel (picture element) placement or vector placement in screen coordinates. Furthermore, the features of Core Graphics free the user from concerns over data acquisition and dislay allowing him to concentrate on the image or Graphics problem at hand.

9200 (INIS-mf—8584, pp 274-278) **Facilities for data file processing in CAMAC systems.** Cermak, V.; Herian, J.; Drnec, I.; Malkovsky, Z.; Roubal, J. (Tesla, Premysleni (Czechoslovakia). Vyzkumny Ustav Pristroju Jaderne Techniky). [nd]. (In Czech). NTIS (US Sales Only), PC A09/MF A01. (CONF-8105231—).

From Conference on nucleonic instruments and their use in the CSSR; Pribram, Czechoslovakia (18 May 1981).

The properties are described of some new units of the NL 2000 CAMAC system. The great variability of the system for autonomous control is shown.

9201 (INIS-mf—8584, pp 279-280) **Design of modular measuring system for nuclear technology.** Lozek, P.; Kostadinov, P. (Ceskoslovenska Komise pro Atomovou Energii, Prague); Hajek, P. (Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia)). [nd]. (In Czech). NTIS (US Sales Only), PC A09/MF A01. (CONF-8105231—).

From Conference on nucleonic instruments and their use in the CSSR; Pribram, Czechoslovakia (18 May 1981).

Published in summary form only.

9202 **(LA-UR—83-3290) Recover it yourself with user logging.** Weir, D. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 11p. (CONF-840248—1). NTIS, PC A02/MF A01. Order Number DE84003783.

From Hewlett-Packard International users group conference; Anaheim, CA, USA (27 Feb 1984).

IMAGE logging is a good product that has proved to be an effective and accurate way to save interactive transactions for recovery and audit purposes. There is one shortcoming with the product in that it only logs transactions within the IMAGE domain. Some applications require that KSAM and MPE files be updated in an on-line system. How can these files be recovered? One answer is to use a recoverable program structure that not only posts the interactive transactions, but recovers them as well. The user logging facility is used to store the successful transactions to either tape or disc. This paper will discuss the recoverable program structure and the user logging subsystem.

9203 **(ORNL/TM—8799) SLITEX: a screen-prompting program for the generation of color text slides.** Johnston, R.B.; Slabbekorn, M.H. (Oak Ridge National Lab., TN (USA)). Nov 1983. Contract W-7405-ENG-26. 17p. NTIS, PC A02/MF A01. Order Number DE84004124.

SLITEX is a program for generating text slides. The FORTRAN program, which uses screen prompting, is designed to provide casual users with a means to generate high-quality, 35-mm color text slides. A variety of background colors having preselected foreground color schemes may be selected by the user. The SLITEX program creates a MAPPER file in the user's area on the PDP-10, which may be submitted to the FR80 film recorder, Versatec printer, or viewed on a graphic display terminal. SLITEX is intended to be used to produce text-only slides; no provision has been made for setting equations using this program.

9204 **(ORNL/TM—8943) Macro-11 intersystem communications program for terminal emulation and file transfer operations.** Goeringer, D.E. (Oak Ridge National Lab., TN (USA)). Nov 1983. Contract W-7405-ENG-26. 17p. NTIS, PC A02/MF A01. Order Number DE84004125.

A MACRO-11 program has been developed which enables a PDP-11 computer system under the RT-11 operating system to communicate with a remote time-sharing computer system. The PDP-11 computer is transparent to the user, so that the console appears to be a time-share terminal. ASCII files can also be transferred between the two computer systems if the remote host is a DEC system supporting the peripheral interchange program (PIP).

9205 **(SAND—83-1346) Factorization using the quadratic sieve algorithm.** Davis, J.A.; Holdridge, D.B. (Sandia National Labs., Albuquerque, NM (USA)). Dec 1983. Contract AC04-76DP00789. 12p. NTIS, PC A02/MF A01. Order Number DE84004140.

Since the cryptosecurity of the RSA two key cryptoalgorithm is no greater than the difficulty of factoring the modulus (product of two secret primes), a code that implements the Quadratic Sieve factorization algorithm on the CRAY I computer has been developed at the Sandia National Laboratories to determine as sharply as possible the current state-of-the-art in factoring. Because all viable attacks on RSA thus far proposed are equivalent to factorization of the modulus, sharper bounds on the computational difficulty of factoring permit improved estimates for the size of RSA parameters needed for given levels of cryptosecurity. Analysis of the Quadratic Sieve indicates that it may be faster than any previously published general purpose algorithm for factoring large integers. The high speed of the CRAY I coupled with the capability of the CRAY to pipeline certain vectorized operations make this algorithm (and code) the front runner in current factoring techniques.

9206 **(SOL—83-19) Representation of a basis for the null space.** Gill, P.E.; Murray, W.; Saunders, M.A.; Wright, M.H. (Stanford Univ., CA (USA). Systems Optimization Lab.). Nov 1983. Contract AT03-76ER72018. 7p. NTIS, PC A02/MF A01. Order Number DE84004639.

Given a rectangular matrix A(x) that depends on the independent variables x, many constrained optimization methods involve computations with Z(x), a matrix whose columns form a basis for the null space of A(x). When A is evaluated at a given point, it is well known that a suitable Z (satisfying $AZ = 0$) can be obtained from standard matrix factorizations. However, Coleman and Sorensen have recently shown that standard orthogonal factorization methods may produce orthogonal bases that do not vary continuously with x; they also suggest several techniques for adapting standard factorization schemes so as to ensure continuity of Z in the neighborhood of a given point. In this note, we discuss several aspects of the representation of a basis for the null space. We describe how an explicit matrix Z can be obtained at any point using a method for updating a factorization with either Householder or stabilized elementary transformations. Under a mild non-singularity assumption, the elements of Z are continuous functions of x. We

also show that the chosen form of Z is convenient and efficient when implementing certain methods for nonlinearly constrained optimization.

9207 **(UCID—19947) Introduction to GEMINI.** Murray, R.C.; Stillman, D.W.; Taylor, R.L. (Lawrence Livermore National Lab., CA (USA)). Dec 1983. Contract W-7405-ENG-48. 190p. NTIS, PC A08/MF A01. Order Number DE84005058.

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These slides were prepared to aid in teaching a course on GEMINI usage as part of the Mechanical Engineering Department's computer code series. The course consisted of 9 fifty-five-minute sessions that were recorded on video tape for TV playback. This document contains copies of the slides used in these sessions.

9208 **(UCID—19954) Graphics specification for graphical requirements for computer-aided control system design.** Bly, S.A. (Lawrence Livermore National Lab., CA (USA)). 14 Dec 1983. Contract W-7405-ENG-48. 28p. NTIS, PC A03/MF A01. Order Number DE84004367.

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The report on graphics for computer-aided control system design (CACSD) is intended to specify the graphics requirements for CACSD and to suggest a method for meeting those requirements. This assumes that there is some basic set of graphical capabilities that is generally useful to the computer-aided control systems community. Given some agreement on that set of capabilities, the problem then is to determine the best way to meet those needs. In the report, current uses of graphics in control system design are considered in order to determine graphical requirements for a CACSD package. An overview of existing graphical capabilities is outlined, including display hardware capabilities, the current efforts at graphics standardization, and graphics software packages. The requirements and capabilities are used to suggest various options for including graphics in CACSD software packages. Finally, a specification for CACSD graphics software is outlined.

9209 **(UCID—19969) Cost savings resulting from standardization and support of personal computers.** Krakowsky, A.M. (Lawrence Livermore National Lab., CA (USA)). 14 Dec 1983. Contract W-7405-ENG-48. 18p. NTIS, PC A02/MF A01. Order Number DE84005112.

To assist laboratory personnel in selecting personal computer (PC) hardware, software, and training to do their work, and to prevent a proliferation of many types of computers, the Systems Development Engineering group of EE's Engineering Services Division began Laboratory-wide support for personal computers at LLNL in January 1983. Net savings of $810K have been extrapolated for the first year's operation by comparing the group's services during the third quarter of 1983 with the same services if performed by users individually. This report explains these services and methods of calculating savings as the group dealt with standardization issues, selection of software, hardware evaluations, and conversion from system to system. Other services such as the newsletter and training, as well as activities not reflected in the yearly saving are described. The Integrated Weapons Contractors who have used the group's information are now setting up their own support groups.

9210 **(UCID—30197) BIMOND: monotone bivariate interpolation code (preliminary documentation).** Fritsch, F.N.; Carlson, R.E. (Lawrence Livermore National Lab., CA (USA)). Dec 1983. Contract W-7405-ENG-48. 28p. NTIS, PC A03/MF A01. Order Number DE84004159.

This report is preliminary documentation for BIMOND, a Fortran 77 subroutine for piecewise bicubic interpolation to data on a rectangular mesh, which reproduces the monotonicity of the data. It is distributed with a driver program BIMOND1, which reads data, computes the interpolating surface parameters, and evaluates the function on a mesh suitable for plotting.

9211 **(USGS-OFR—82-68) Adaptive nonlinear least-squares solution for constrained or unconstrained minimization problems (subprogram NLSOL).** Anderson, W.L. (Geological Survey, Reston, VA (USA)). 1982. 65p. USGS-Open File Services Center, Box 25425-Denver Federal Center, Denver, CO 80225.

Subprogram NLSOL is a general interface routine written for the VAX-11/780 system using a comprehensive adaptive nonlinear least-squares algorithm published by Dennis and others (1979). The intent of this interface is to provide a uniform calling approach for any nonlinear function, and to extend Dennis's unconstrained minimization algorithm, external to the original (unchanged) code, with additional options to perform either unconstrained or constrained adaptive nonlinear regression for arbitrary nonlinear least-squares problems, to hold certain parameters fixed (i.e., assigned as constants) during the nonlinear least-squares regression, to provide for a weighted least-squares fit, and to control reading the observed data matrix using any object (run-time) format.

9212 **Parallel algorithms for network routing problems and recurrences.** Wisniewski, J.A. (Sandia Labs., Albuquerque, NM); Sameh, A.H. *SIAM Journal on Algebraic and Discrete Methods;* **3**: No. 3, 379-394(Sep 1982).

In this paper, we consider the parallel solution of recurrences, and linear systems in the regular algebra of Carre. These problems are equivalent to solving the shortest path problem in graph theory, and they also arise in the analysis of Fortran programs. Our methods for solving linear systems in the regular algebra are analogues of well-known methods for solving systems of linear algebraic equations. A parallel version of Dijkstra's method, which has no linear algebraic analogue, is presented. Considerations for choosing an algorithm when the problem is large and sparse are also discussed.

9213 **Turning-point connection at close quarters.** Painter, J.F. (Lawrence Livermore Lab., CA); Meyer, R.E. *SIAM Journal of Mathematical Analysis;* **13**: No. 4, 541-554(Jul 1982). Contract W-7405-ENG-48.

WKB-connection theory across singular and turning points of linear second order differential equations is extended from Langer's [1931], [1932] class of fractional turning points to a larger one including logarithmic turning points and even more irregular, singular points. Uniform approximations of solutions then become necessarily much less tractable and useful, but this is shown not to affect the first order WKB-connection formulae of primary practical importance. The extension is achieved by a new connection method which abandons the reliance on progressive paths to control the rapidly varying exponentials.

9214 **Further results on periods and period doubling for iterates of the trapezoic function.** Beyer, W.A.; Stein, P.R. (Los Alamos Scientific Lab., NM). *Adv. Appl. Math.;* **3**: 265-287(1982).

The trapezoidal function λ f/sub e/(x), is defined for fixed e ϵ (0,1] and for $\lambda \epsilon$ [1,2] by λ f/sub e/ (x) = λ for /x-1/< 1-e and λ f/sub e/(x) = λ(1-/x-1/)/(1-e) for 1 $\geq$ /x-1/$\geq$ 1-e. For a fixed e, this is a one parameter family of endomorphisms of the interval [0,2]. The structure of the periods (or cycles) of these mappings is studied. In addition, the metric properties of the corresponding bifurcation diagrams are considered; in particular, the rate of convergence of a sequence of bifurcation points in the (x,λ) plane is studied. It is shown to be different from that found by Feigenbaum and others for mappings which are not flat at the top. The limiting case e = 1 is of special interest. For cycles and containing a point x ϵ[e,2-e], the period quadruplicates instead of doubling as it does in the usual case.

9215 **Standard and goodness-of-fit parameter estimation methods for the three-parameter lognormal distribution.** Kane, V.E. (Union Carbide Corp., Oak Ridge, TN). *Communications in Statistics, (Part A), Theory and Methods;* **11**: No. 17, 1935-1957(1982).

A class of goodness-of-fit estimators is found to provide a useful alternative in certain situations to the standard maximum likelihood method which has some undesirable estimation charac-

teristics for estimation from the three-parameter lognormal distribution. The class of goodness-of-fit tests considered include the Shapiro-Wilk and Filliben tests which reduce to a weighted linear combination of the order statistics that can be maximized in estimation problems. The weighted order statistic estimators are compared to the standard procedures in Monte Carlo simulations. Robustness of the procedures are examined and example data sets analyzed.

9903 Information Handling

REFER ALSO TO CITATION(S) 7194

9216 **(CONF-8309188—1) Management of aerospace contract documentation by industry and government.** Coppock, E.G. (USDOE Technical Information Center, Oak Ridge, TN). 1983. 18p. NTIS, PC A02/MF A01. Order Number DE84900451.

From NATO conference on the application of new technologies to improve the delivery of aerospace and defense information; Ottawa, Canada (14 Sep 1983).

The paper reviews methods of documenting and tracking contract requirements and deliverables from the inception of a project through its completion. One specific system, the Technical Information Monitoring System, will be discussed in detail. Emphasis is placed on the tracking of deliverables in the form of technical reporting requirements for research and development contracts for the US Department of Energy. In addition, the paper concentrates on the application of new technologies to improve productivity and reduce overlap in energy research and development and to enhance contract documentation and accelerate the dissemination of contractor research and development reports and technical information.

9217 **Managing facts and concepts: computer graphics and information graphics from a graphic designer's perspective.** Marcus, A. Berkeley, CA; Lawrence Berkeley Laboratory (1983). 48p.

This book emphasizes the importance of graphic design for an information-oriented society. In an environment in which many new graphic communication technologies are emerging, it raises some issues which graphic designers and managers of graphic design production should consider in using the new technology effectively. In its final sections, it gives an example of the steps taken in designing a visual narrative as a prototype for responsible information-oriented graphic design. The management of complex facts and concepts, of complex systems of ideas and issues, presented in a visual as well as verbal narrative or dialogue and conveyed through new technology will challenge the graphic design community in the coming decades. This shift to visual-verbal communication has repercussions in the educational system and the political/governance systems that go beyond the scope of this book. If there is a single goal for this book, it is to stimulate the reader and then to provide references that will help you learn more about graphic design in an era of communication when know business is show business.

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  Qualifier
    Title, (supplementary information), citation number, (R;US)

The notations in the final parentheses indicate the type of document, e.g., R for Report; the country of publication, e.g., US; and the language if other than English, e.g., In German. Tables of document types and country of publication codes appear after the indexes.

The title may be supplemented with additional words, or a phrase, if it appears additional information would be helpful. In cases for which the title contains little or no information related to the subject entry, it may be replaced entirely by the supplementary information. A qualifier is not always required, and in such cases the title will follow the unqualified subject descriptor.

The descriptors selected for use as subject terms are generally the names of specific materials, things, or processes. To the extent possible, a qualifier is selected to describe the properties of, or processes applied to, the subject term.

Index entries are selected to indicate the important ideas and concepts presented in a document, rather than words that may appear in the text. Within the available thesaurus terms, the most probable or logical place to look for typical information is selected. "See references" are included to guide users from synonymous terms or phrases to the descriptor selected as a subject heading for the concept. (e.g. Pipeline Quality Gas see HIGH BTU GAS). "See also references" are used to indicate where to find references to subject concepts that are narrower, broader, or related to a particular subject heading. To complete an exhaustive search of a given subject, all such headings should be reviewed. Copies of DOE/TIC-7000, the Subject Thesaurus, are available from the National Technical Information Service (NTIS), U. S. Department of Commerce, Springfield, VA 22161.

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AC02-80ER10556	**Division of Engineering, Brown University, Providence, RI 02912**	
	9:9051	Acta Metallurgica 31 NO. 6. 919-926 (Jan 1983).

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AC02-80ER10566	**Department of Mechanical Engineering, University of Massachusetts, Amherst, Massachusetts 01003**	
	9:7970	Journal of Applied Physics 55 NO. 2. 331-337 (15 Jan 1984).
AC02-80ER10569	**Laboratory of Plasma Studies and School of Electrical Engineering, Cornell University, Ithaca, New Y**	
	9:9104	Physics of Fluids 27 NO. 1. 4-7 (Jan 1984).
AC02-80ER10654	**Dept. of Physics, Brooklyn College, City University of New York, Brooklyn, NY**	
	9:8182	Journal of the Electrochemical Society 130 NO. 7. 1514-1518 (Jul 1983).
AC02-80ER10740	**State Univ. of New York, Stony Brook (USA). Dept. of Materials Science and Engineering**	
	9:8056	DOE/ER/10740—12
	9:8471	Review of Scientific Instruments 55 NO. 1. 107-109 (Jan 1984).
AC02-80ER10773	**Astronomy and Astrophysics Center, Enrico Fermi Institute, The University of Chicago, Chicago, Illin**	
	9:8689	Physical Review Letters 51 NO. 18. 1625-1628 (31 Oct 1983).
AC02-80ET25209	**State Univ. of New York, Stony Brook (USA)**	
	9:7354	DOE/ET/25209—1
AC02-80EV10468	**Marine Biological Lab., Woods Hole, MA (USA). Ecosystems Center**	
	9:8545	DOE/EV/10468—T1
AC02-81ER10814	**Purdue University, West Lafayette, IN 47907**	
	9:7983	Metallurgical Transactions, [Section] A: Physical Metallurgy and Materials Science 14A NO.
AC02-81ER10861	**Princeton Univ., NJ**	
	9:8166	Journal of the American Chemical Society 105 NO. 17. 5601-5607 (24 Aug 1983).
AC02-81ER10866	**Northeastern Univ., Boston, MA (USA)**	
	9:8022	DOE/ER/10866—3
	9:8057	DOE/ER/10866—T1
	Northeastern Univ., Boston, MA (USA). Dept. of Physics	
	9:9048	DOE/ER/10866—T2
AC02-81ER10914	**Dynatech Research and Development Company, Chemical Engineering Group, Cambridge, Massachusetts**	
	9:8181	Journal of the Electrochemical Society 130 NO. 9. 1844-1848 (Sep 1983).
AC02-81ER10942	**Michigan State Univ., East Lansing (USA). Dept. of Metallurgy, Mechanics and Material Science**	
	9:7865	DOE/ER/10942—4
	9:7866	DOE/ER/10942—5
	9:7867	DOE/ER/10942—6
	9:7868	DOE/ER/10942—7
AC02-81ER40001	**Wisconsin Univ., Madison (USA)**	
	9:8707	DOE/ER/40001—36
AC02-81ER40023	**Brooklyn Coll. of CUNY, Brooklyn, NY 11210**	
	9:8868	IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science 3
AC02-81ER40025	**Department of Physics, University of Colorado, Boulder, Colorado 80309**	
	9:8777	Physical Review [Section] D: Particles and Fields 28 NO. 11. 2721-2725 (1 Dec 1983).

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AC02-82CE40582	**Thermo Electron Corporation, Waltham, MA 02254**	
	9:7752	Proceedings, Intersociety Energy Conversion Engineering Conference 1 186-191 (Aug 1983).
AC02-82ER12038	**Cornell Univ., Ithaca, NY (USA). Dept. of Materials Science and Engineering**	
	9:7869	DOE/ER/12038—8
	9:7870	DOE/ER/12038—9
	9:7871	DOE/ER/12038—10
	9:7872	DOE/ER/12038—11
	Cornell Univ., Ithaca, NY (USA). Dept. of Theoretical and Applied Mechanics	
	9:7873	DOE/ER/12038—12
	Cornell Univ., Ithaca, NY (USA)	
	9:7874	DOE/ER/12038—13
AC02-82ER12076	**Cornell Univ., Ithaca, NY (USA)**	
	9:8024	DOE/ER/12076—T1
AC02-82ER60036	**Institute of Occupational Medicine, Edinburgh (UK)**	
	9:7248	DOE/ER/60036—T1
AC02-82ER60045	**Bermuda Biological Station, Ferry Reach**	
	9:8511	DOE/ER/60045—T1(Rev.)
AC02-83CH10140	**Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation**	
	9:7264	BMI/ONWI—519-Draft
	Bendix Field Engineering Corp., Grand Junction, CO (USA)	
	9:7265	BMI/ONWI—5001
AC02-83ER52090	**Wisconsin Univ., Madison (USA). Dept. of Electrical and Computer Engineering**	
	9:9143	DOE/ER/52090—1
AC02-83ER60121	**Cooperative Inst. for Research in Environmental Science, Boulder, CO (USA)**	
	9:7249	DOE/ER/60121—T1
AC03-76CS32400	**Alabama Power Co., Birmingham (USA)**	
	9:7383	CAPE—2910(31 Aug 1976).
AC03-76SF00098	**Lawrence Berkeley Lab., CA (USA)**	
	9:7439	LBL—16748
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	9:7633	LBL—15051
	9:7779	Energy Technology (Washington, D.C.) 9 359-368 (Jun 1982).
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	9:7989	Journal of the Electrochemical Society 130 NO. 7. 1519-1523 (Jul 1983).
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	9:8177	Accounts of Chemical Research 16 NO. 10. 370-376 (Oct 1983).
	9:8196	LBL—16690
	9:8200	Inorganic Chemistry 22 NO. 17. 2351-2355 (17 Aug 1983).
	9:8231	IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics 19 NO.
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	9:8365	LBL—15983
	9:8366	LBL—16744
	9:8367	LBL—16835
	9:8446	LBL—15960

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	9:8466	LBL—15942
	9:8572	LBL—16811
	9:8615	LBL—14772-Rev.
	9:8717	LBL—16892
	9:8735	LBL—16702
	9:8810	LBL—16800
	9:9028	
	9:9153	LBL—16866
	9:9154	LBL—16871
	9:9189	LBL-PUB—5102
	9:9198	DOE/TIC—11616
AC03-76SF00515	Stanford Linear Accelerator Center, CA (USA)	
	9:8292	SLAC-CN—257
	9:8312	SLAC-CN—251
	9:8313	SLAC-CN—253
	9:8314	SLAC-CN—254
	9:8315	SLAC-CN—259
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	9:8814	Physical Review [Section] D: Particles and Fields 28 NO. 11. 2867-2871 (1 Dec 1983).
	9:9194	CONF-8305146—
AC03-77ET33006	TRW Energy Development Group, One Space Park, Redondo Beach, CA 90278	
	9:8229	IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics 19 NO.
AC03-82SF11681	Whiddon (W.I.) and Associates, Inc., Bethesda, MD (USA)	
	9:7414	DOE/SF/11681—T1
AC04-76DP00053	Monsanto Research Corp., Miamisburg, OH (USA). Mound	
	9:7110	MLM-MU—83-71-0002
	9:7315	NUREG/CR—2078
	9:8125	MLM—3115(OP)
	9:8126	MLM—3127
	9:8477	MLM—3111(OP)
	9:8478	MLM—3113-OP
	9:8479	MLM—3114(OP)
	9:8480	MLM—3117-OP
	9:8481	MLM—3119(OP)
AC04-76DP00613	Bendix Corp., Kansas City, MO (USA)	
	9:7840	BDX—613-3009
AC04-76DP00656	General Electric Company, Neutron Devices Department, St. Petersburg, Florida 33733	
	9:9063	Journal of Applied Physics 55 NO. 1. 158-161 (1 Jan 1984).
AC04-76DP00789	Sandia National Labs., Albuquerque, NM (USA)	
	9:7221	SAND—83-2005
	9:7263	SAND—83-2592C
	9:7282	NUREG/CR—2937
	9:7283	NUREG/CR—3129
	9:7285	NUREG/CR—3353
	9:7316	NUREG/CR—3088
	International Energy Associates Ltd., Washington, DC (USA)	
	9:7318	NUREG/CR—3347-Vol.1
	9:7319	NUREG/CR—3347-Vol.3
	9:7320	NUREG/CR—3348
	9:7321	NUREG/CR—3349
	Jet Propulsion Lab., Pasadena, CA (USA)	
	9:7379	DOE/JPL—1060-61-Vol.1
	9:7380	DOE/JPL—1060-61-Vol.2
	Sandia National Labs., Albuquerque, NM (USA)	
	9:7460	SAND—83-0844
	9:7558	NUREG/CR—2462
	9:7648	NUREG/CR—3538
	9:7649	SAND—83-1810C
	9:7650	SAND—83-1868C
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	9:7746	Proceedings, Intersociety Energy Conversion Engineering Conference 1 222-226 (Aug 1983).
	9:7837	CONF-8306141—1
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	9:8076	Applied Physics Letters 44 NO. 1. 51-53 (1 Jan 1984).
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	9:8085	Nuovo Cimento della Societa Italiana di Fisica, [Sezione] D: Condensed Matter, Atomic, Mol
	9:8128	SAND—83-1582C
	9:8169	Surface Science 115 159-164 (1982).
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	9:8273	Journal of the Electrochemical Society 130 NO. 7. 1567-1571 (Jul 1983).
	9:8497	CONF-840133—3
	9:8664	Radioactive Waste Management and the Nuclear Fuel Cycle 4 NO. 1. 1-31 (Sep 1983).
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	9:9173	Journal of Applied Physics 55 NO. 1. 138-149 (1 Jan 1984).
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	9:9205	SAND—83-1346
AC04-77AL04047	EG and G, Inc., Salem, MA (USA)	
	9:8271	DOE/AL/04047—T12
AC04-82ER60095	New Mexico Inst. of Mining and Technology, Socorro (USA). Dept. of Physics	
	9:8527	DOE/ER/60095—T1
AC05-76OR00033	Oak Ridge Associated Universities, Inc., TN (USA)	
	9:7792	ORAU/IEA—83-10(M)
AC05-83ER51035	McDonnell Douglas Astronautics Co., St. Louis, MO (USA)	
	9:9076	DOE/ER/51035—T1
AC06-76FF02170	Hanford Engineering Development Lab., Richland, WA (USA)	
	9:7253	HEDL-SA—2903-FP
	GA Technologies, Inc., San Diego, CA (USA)	
	9:7254	HEDL-SA—2906-FP
	Hanford Engineering Development Lab., Richland, WA (USA)	
	9:7533	HEDL-SA—2960
	9:7534	HEDL-SA—2966
	9:7622	HEDL-SA—2867-FP
	9:7623	HEDL-SA—2965-FP
	9:7624	HEDL-SA—2965-S
	Westinghouse Hanford Co., Richland, WA (USA)	
	9:7879	HEDL—7418
	9:7880	HEDL—7419
	Hanford Engineering Development Lab., Richland, WA (USA)	
	9:7881	HEDL-SA—2904-FP
	9:8217	HEDL-SA—2915-FP
	9:9147	HEDL-SA—2889-FP
	9:9148	HEDL-SA—2923
	9:9149	HEDL-SA—2999-FP

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AC06-76RL01830	**Battelle, Pacific Northwest Lab., Richland, WA**	
	9:7170	American Chemical Society, Division of Petroleum Chemistry, Preprints 28 NO. 5. 1203-1207
	Pacific Northwest Lab., Richland, WA (USA)	
	9:7262	PNL-SA—11124
	Pennsylvania State Univ., University Park (USA). Materials Research Lab.	
	9:7287	ONWI—479
	Pacific Northwest Lab., Richland, WA (USA)	
	9:7307	PNL-SA—11610
	9:7308	NUREG/CR—3125
	9:7309	NUREG/CR—3395
	9:7317	NUREG/CR—3256
	9:7332	PNL-SA—11807
	9:7562	PNL-SA—11396
	9:7568	PNL-SA—11381
	9:7757	Corrosion (Houston) 39 NO. 5. 202-203 (May 1983).
	9:7793	PNL-SA—11300
	Cummins Engine Co., Inc., Columbus, IN (USA)	
	9:7827	DOE/RL/01830—T10
	Pratt and Whitney Aircraft, East Hartford, CT (USA). Commercial Products Div.	
	9:7828	DOE/RL/01830—T13
	Pacific Northwest Lab., Richland, WA (USA)	
	9:7919	PNL-SA—11436
	9:7986	Metallurgical Transactions, [Section] A: Physical Metallurgy and Materials Science 14A NO.
	9:8205	PNL—4917
	9:8226	PNL-SA—11743
	9:8520	PNL-SA—11561
	9:8521	PNL-SA—11798
	9:8530	NUREG/CR—3344
	9:8531	NUREG/CR—3368
	9:8543	PNL-SA—11782
	9:8549	NUREG/CR—3408
	9:8550	PNL-SA—11924
	9:8616	PNL-SA—11571
	9:8630	PNL-SA—11744
	9:8645	PNL—4882
AC06-76RL01857	**UNC Nuclear Industries, Inc., Richland, WA (USA)**	
	9:7505	UNI—2288
AC06-77RL01030	**Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations**	
	9:7292	RHO-PB-SR—10-B-WM-Nov.83
AC07-76ID01570	**EG and G Idaho, Inc., Idaho Falls (USA)**	
	9:7273	EGG-REP—6440
	Idaho National Engineering Lab., Idaho Falls (USA)	
	9:7480	EGG-M—21083
	EG and G Idaho, Inc., Idaho Falls (USA)	
	9:7488	EGG-TMI—6443
	9:7575	GEND—037
	9:7583	EGG-SE—6464
	9:7619	EGG-EA—6467
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	9:8371	EGG-HS—6378
	Idaho National Engineering Lab., Idaho Falls (USA)	
	9:8528	EGG-PBS—6479
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	9:8915	EGG-M—14183
	9:9065	Journal of Nondertructive Evaluation 3 NO. 1. 25-35 (Mar 1982).
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AC07-78ID01745	**Mountain States Energy, Inc.**	
	9:7737	Proceedings, Intersociety Energy Conversion Engineering Conference 1 151-154 (Aug 1983).
	9:7738	Proceedings, Intersociety Energy Conversion Engineering Conference 1 155-162 (Aug 1983).
AC07-79ID01675	**Exxon Nuclear Idaho Co., Inc., Idaho Falls (USA)**	
	9:7274	ENICO—1116
AC08-76NV00038	**Seismograph Service Corp., Tulsa, OK (USA)**	
	9:8648	CONF-8309104—3
AC08-79ET27111	**Texas Univ., Austin (USA). Bureau of Economic Geology**	
	9:7444	DOE/ET/27111—T2
AC08-80DP40124	**Rochester Univ., NY (USA). Lab. for Laser Energetics**	
	9:9139	DOE/DP/40124—10
AC08-82DP40152	**KMS Fusion, Inc., Ann Arbor, Michigan 48106**	
	9:9103	Physics of Fluids 27 NO. 1. 242-246 (Jan 1984).
AC08-82NV10250	**Westinghouse Electric Corp., Mercury, NV (USA). Waste Technology Services Div.**	
	9:7270	DOE/NV/10250—11
	9:7271	DOE/NV/10250—12
AC08-83NV10282	**EG and G Energy Measurements, Incorporated, Santa Barbara Operations, Goleta, California 93117**	
	9:8071	Applied Physics Letters 44 NO. 2. 177-179 (15 Jan 1984).
AC09-76SR00001	**Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.**	
	9:7256	DP—1656
	9:7259	
	9:7556	DP-MS—83-25
	9:8137	
	9:8513	DP-MS—83-12-Rev.1
AC13-76GJ01664	**Bendix Field Engineering Corp., Grand Junction, CO (USA)**	
	9:8102	GJ/TMC—07(83)
AC15-76CL50003	**Westinghouse Electric Corp., Madison, PA (USA). Advanced Energy Systems Div.**	
	9:7531	CONF-830905—9
AC18-79ET14693	**North Carolina Univ., Chapel Hill (USA). Dept. of Geology**	
	9:7145	DOE/ET/14693—T11
AC19-79BC10069	**Illinois Inst. of Technology**	
	9:7206	SPEJ, Society of Petroleum Engineers Journal 23 NO. 4. 602-612 (Aug 1983).
AC19-80BC10257	**Texas Tech Univ., Lubbock (USA). Dept. of Mathematics**	
	9:7193	DOE/BC/10257—59
AC21-79ET14204	**United States Steel Corp., Monroeville, PA. Research Lab.**	
	9:7159	DOE/ET/14204—1477
AC21-80ET14705	**Stearns-Roger, Inc., Denver, CO (USA)**	
	9:7096	DOE/ET/14705—1506
AC21-80ET14928	**General Electric Co., Schenectady, NY (USA). Corporate Research and Development Dept.**	
	9:7098	DOE/ET/14928—1516
	9:7099	DOE/ET/14928—1518
AC21-80ET15492	**Air Pollution Technology, Inc., San Diego, CA (USA)**	
	9:7137	DOE/ET/15492—T44
AC21-80MC14600	**Ingersoll-Rand Research, Inc., Princeton, NJ (USA)**	
	9:7102	DOE/MC/14600—1427
AC21-81FE05122	**Advanced Fuel Research, Inc., East Hartford, CT (USA)**	
	9:7100	DOE/FE/05122—1485

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AC21-82MC19299	Lockheed Missiles and Space Co., Inc., Sunnyvale, CA (USA). Energy Systems	
	9:7103	DOE/MC/19299—12
AC21-82MC19403	Institute of Gas Technology, Chicago, IL (USA)	
	9:7104	DOE/MC/19403—1520
AC21-83MC20013	Holder (G.D.), Pittsburgh, PA (USA)	
	9:7233	DOE/MC/20013—T3
AC21-83MC20201	Frumerman Associates, Inc., Pittsburgh, PA (USA)	
	9:7225	DOE/MC/20201—T4
AC21-83MC20334	Massachusetts Inst. of Tech., Cambridge (USA)	
	9:8279	DOE/MC/20334—T1
AC22-76ET10532	Chevron Research Co., Richmond, CA (USA)	
	9:7095	DOE/ET/10532—T14
AC22-77EV04427	Bituminous Coal Research, Inc., Monroeville, PA (USA)	
	9:7163	DOE/EV/04427—62
AC22-78ET10787	Avco Everett Research Laboratory, Inc.	
	9:7741	Proceedings, Intersociety Energy Conversion Engineering Conference 3 1208-1216 (Aug 1982).
AC22-79ET14803	Amoco Oil Co., Naperville, IL (USA). Research and Development Dept.	
	9:7097	DOE/ET/14803—T8
AC22-80ET15614	Avco Everett Research Laboratory, Inc., Everett, Massachusetts 02149	
	9:7735	Proceedings, Intersociety Energy Conversion Engineering Conference 1 131-137 (Aug 1983).
	9:7742	Proceedings, Intersociety Energy Conversion Engineering Conference 3 1223-1228 (Aug 1982).
AC22-80PC30071	Mitre Corp., McLean, VA (USA). METREK Div.	
	9:8512	DOE/PC/30071—1
AC22-81PC40269	Institute of Gas Technology, Chicago, IL (USA)	
	9:8280	DOE/PC/40269—22
AC22-81PC40502	TRW Energy Development Group, Redondo Beach, California	
	9:7174	Proceedings, Intersociety Energy Conversion Engineering Conference 1 125-130 (Aug 1983).
AC22-82PC50046	Pittsburg and Midway Coal Mining Co., Denver, CO (USA)	
	9:7106	DOE/PC/50046—T1
AC22-83PC60418	Solar Turbines International, San Diego, CA (USA)	
	9:7138	DOE/PC/60418—T1
AC22-83PC62255	Orkand Corp., Silver Spring, MD (USA)	
	9:7107	DOE/PC/62255—T1
AC97-80ET46617	Texas Univ., Austin (USA). Bureau of Economic Geology	
	9:8641	DOE/ET/46617—T4
AI01-76ET20320	National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center	
	9:7466	DOE/NASA/20320—56
AI01-81CS24362	Union County Planning Dept., La Grande, OR (USA)	
	9:7461	DOE/CS/24362—T1
	Coury and Associates, Lakewood, CO (USA)	
	9:7462	DOE/CS/24362—T10
	Ebasco Services, Inc., New York (USA)	
	9:7463	DOE/CS/24362—T15
	Department of Housing and Urban Development, Washington, DC (USA)	
	9:7464	DOE/CS/24362—T19
	9:7800	CONF-8210227—Summs.
	Atlanta Office of Budget, Audit and Management, GA (USA)	
	9:7801	DOE/CS/24362—T2
	Department of Housing and Urban Development, Washington, DC (USA)	
	9:7802	DOE/CS/24362—T3
	Missoula Planning Office, MT (USA)	
	9:7803	DOE/CS/24362—T4
	Pequod Associates, Inc., Boston, MA (USA)	
	9:7804	DOE/CS/24362—T5
	Smith-Hinchman and Grylls Associates, Inc., Detroit, MI (USA)	
	9:7805	DOE/CS/24362—T6
	Resource Development Associates, Inc., Dayton, OH (USA)	
	9:7806	DOE/CS/24362—T7
	Timmerman (Robert W.) and Associates, Boston, MA (USA)	
	9:7807	DOE/CS/24362—T8
	Columbus Dept. of Energy and Telecommunication, OH (USA)	
	9:7808	DOE/CS/24362—T9
	Burns and Roe, Inc., Oradell, NJ (USA)	
	9:7809	DOE/CS/24362—T11
	Albany, City of, NY (USA)	
	9:7810	DOE/CS/24362—T12
	Dewberry and Davis, Marion, VA (USA)	
	9:7811	DOE/CS/24362—T13
	Resource Development Associates, Marietta, GA (USA)	
	9:7812	DOE/CS/24362—T14
	New York City Energy Office (USA)	
	9:7813	DOE/CS/24362—T16
	Smith-Hinchman and Grylls Associates, Inc., Detroit, MI (USA)	
	9:7814	DOE/CS/24362—T17
	Santa Ana Pueblo, Bernalillo, NM (USA)	
	9:7815	DOE/CS/24362—T18
AI01-82CS50286	Aerospace Corp., El Segundo, CA (USA). Energy Conservation Directorate	
	9:7826	DOE/CS/50286—4
AI08-79DP40092	Naval Research Lab., Washington, DC (USA)	
	9:9156	NRL-MR—5219
AM03-76SF00010	Division of Engineering and Applied Science, California Institute of Technology, Pasadena, Californi	
	9:8470	Applied Physics Letters 44 NO. 2. 153-155 (15 Jan 1984).
AM03-76SF00113	Univ. of Southern California	
	9:7208	SPEJ, Society of Petroleum Engineers Journal 23 NO. 3. 440-446 (Jun 1983).
AS05-76ER02408	North Carolina Univ., Chapel Hill (USA). Dept. of Physics and Astronomy	
	9:8705	DOE/ER/02408—214
AS05-76ER03624	Duke Univ., Durham, NC (USA)	
	9:8832	DOE/ER/03624—24
AS05-76EV01643	Tennessee Univ., Memphis (USA). Center for Health Sciences	
	9:8538	DOE/EV/01643—150
AS05-76EV03018	Louisiana State Univ., Baton Rouge (USA)	
	9:8184	CONF-820853—Absts.
AS05-76EV03798	Florida Univ., Gainesville (USA). Dept. of Nuclear Engineering Sciences	
	9:9029	DOE/EV/03798—61
AS05-76EV05163	Miami Univ., FL (USA). Rosenstiel School of Marine and Atmospheric Sciences	
	9:8668	DOE/EV/05163—7
AS05-78ER05947	Florida Univ., Gainesville (USA)	
	9:7192	CONF-790913—11
AS05-78ET52025	Georgia Inst. of Tech., Atlanta (USA)	
	9:9146	GTFR—45
AS05-79ER10489	Tennessee Technological Univ., Cookeville	
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AS05-80ER10627	North Carolina State Univ., Raleigh (USA). Dept. of Nuclear Engineering	
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AS05-80ER10711	Virginia Polytechnic Inst. and State Univ., Blacksburg (USA)	
	9:9069	DOE/ER/10711—2
AS05-80ER10714	Tennessee Technological Univ., Cookeville (USA). Dept. of Physics	
	9:8851	DOE/ER/10714—3
AS05-80EV10404	Texas A and M Univ., College Station (USA). Dept. of Chemistry	
	9:7217	DOE/EV/10404—T5
	9:8101	DOE/EV/10404—7
AS05-81ER10803	Florida State Univ., Tallahassee (USA)	
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AS07-78ID01717	New Mexico State Univ., Las Cruces (USA). New Mexico Energy Inst.	
	9:7441	DOE/ID/01717—4
AS08-81DP40132	Illinois Univ., Urbana (USA). Fusion Studies Lab.	
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AS08-81DP40139	Laboratory of Plasma Studies, Cornell University, Ithaca, New York 14853	
	9:8723	Physics of Fluids 27 NO. 1. 285-290 (Jan 1984).
AS08-81DP40163	Electrical Engineering Department, University of California, Los Angeles, California 90024	
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AS09-76EV00639	Georgia Univ., Athens (USA). Inst. of Ecology	
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AS09-76EV00890	Georgia Inst. of Tech., Atlanta (USA)	
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AS09-76EV00901	Skidaway Inst. of Oceanography, Savannah, GA (USA)	
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AS09-80ER10671	Clemson Univ., SC (USA). Dept. of Chemistry	
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AS20-81LC10678	Arizona Univ., Tucson (USA). Dept. of Civil Engineering and Engineering Mechanics	
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AS21-77ET10480	Oregon State Univ., Corvallis (USA)	
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AT01-79CS40192	Massachusetts Inst. of Tech., Cambridge (USA). Center for Policy Alternatives	
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AT03-76ER70030	Rockwell International Corp., Canoga Park, CA (USA). Energy Systems Group	
	9:7130	ESG-DOE—13419
AT03-76ER72004	California Inst. of Tech., Pasadena (USA). Div. of Chemistry and Chemical Engineering	
	9:8172	DOE/ER/72004—T2
AT03-76ER72018	Stanford Univ., CA (USA). Systems Optimization Lab.	
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AT03-76ET35300	GA Technologies, Inc., San Diego, CA (USA)	
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AT03-76ET51011	General Atomic Company, San Diego, California	
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AT03-76EV70118	California Univ., Los Angeles (USA)	
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AT03-76SF70046	General Atomic Company, San Diego, CA	
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AT03-76SF72017	Gulf General Atomic Co., San Diego, CA (USA)	
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AT03-79ER10378	Department of Materials Science and Engineering, Stanford University, Stanford, CA 94305	
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AT03-80ER10626	California Univ., Riverside (USA)	
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AT03-80ER10659	Department of Chemical Engineering, Stanford University, Stanford, California 94305	
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AT03-80SF11512	Japan Atomic Energy Research Institute, Ibaraki, Japan at the General Atomic Company, San Diego, Cal	
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AT03-81ER10870	California Inst. of Tech., Pasadena (USA). W.M. Keck Lab. of Engineering Materials	
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AT03-81SF11562	University of Southern California, Los Angeles (USA)	
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FC01-75CS28064	Indianapolis Center for Advanced Research, IN (USA)	
	9:7816	DOE/CS/28064—T1
FC01-79ER10000	Texas Instruments, Inc., Dallas (USA). Central Research Lab.	
	9:7352	DOE/ER/10000—T3
	9:7353	DOE/ER/10000—T4
FC02-80CS30525	Kool View Co., Inc., Madison, WI (USA)	
	9:7766	DOE/CS/30525—25
FC05-77ET10069	Exxon Research and Engineering Co., Baytown, TX (USA). Baytown Research and Development Div.	
	9:7091	CONF-840201—1
	Exxon Research and Engineering Co., Florham Park, NJ (USA)	
	9:7094	DOE/ET/10069—T78
FC21-83FE60181	North Dakota Univ., Grand Forks (USA). Energy Research Center	
	9:7082	DOE/FE/60181—26
FG01-78CS20423	American Planning Association, Chicago, IL	
	9:7824	DOE/CS/20423—T1
FG01-78RG09065	Arkansas Office of the Attorney General, Little Rock (USA). Div. of Energy Conservation and Rate Advocacy	
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FG01-80CS20560	American Hydrotherm Corp., New York	
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FG01-80CS24101	Urban Land Inst., Washington, DC (USA)	
	9:7765	DOE/CS/24101—T1
FG01-80CS24204	Southwest Arkansas Planning and Development District, Inc., Magnolia (USA)	
	9:7175	DOE/CS/24204—T1
FG01-80CS50225	Brobeck (William M.) and Associates, Berkeley, CA (USA)	
	9:7829	DOE/CS/50225—T1
	Dutcher Industries, Inc., San Diego, CA (USA)	
	9:7830	DOE/CS/50225—T2
FG02-80R510244	Ohio State Univ., Wooster (USA). Agricultural Technical Inst.	
	9:7335	DOE/R5/10244—4
FG05-80ET53088	Texas Univ., Austin (USA). Inst. for Fusion Studies	
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FG06-80ET41107	League of Women Voters Education Fund, Washington, DC (USA)	
	9:7697	DOE/ET/41107—T1
FG22-80PC30237	Alaska Univ., Fairbanks (USA). Mineral Industry Research Lab.	
	9:7131	MIRL—64
FG22-81PC40283	Princeton Univ., NJ (USA). Dept. of Mechanical and Aerospace Engineering	
	9:8204	DOE/PC/40283—1
FG22-81PC40789	Purdue Univ., Lafayette, IN (USA). School of Mechanical Engineering	
	9:7129	DOE/PC/40789—T8
FG22-81PC40804	Illinois Univ., Urbana (USA). Dept. of Mechanical and Industrial Engineering	
	9:8250	DOE/PC/40804—T7
FG22-82PC51505	Pittsburgh Univ., PA (USA). Dept. of Chemical and Petroleum Engineering	
	9:7164	DOE/PC/51505—T1
FG44-80R410142	Coalition for Safe Energy, Greensboro, NC (USA)	
	9:7384	DOE/R4/10142—T1
FG44-80R410152	Masiko (Peter), Miami, FL (USA)	
	9:7385	DOE/R4/10152—T1
FG46-79R610956	Briggs (James D.), Kerrville, TX (USA)	
	9:7768	DOE/R6/10956—T1
FG46-79R610960	Duncan (Laura S.), Austin, TX (USA)	
	9:7386	DOE/R6/10960—T1
FG46-79R610966	Vincent (John R.), San Juan Pueblo, NM (USA)	
	9:7387	DOE/R6/10966—T1
FG46-79R610971	Electro Magnetic Applications, Inc., Albuquerque, NM (USA). Solar Div.	
	9:7388	DOE/R6/10971—T1
FG46-79R610973	High Technology Associates, Fronton, TX (USA)	
	9:7389	DOE/R6/10973—T1
FG46-79R610976	Jicarilla Apache Tribe, Dulce, NM (USA). Community Action Program	
	9:7390	DOE/R6/10976—T1
FG46-79R610978	Board of Trustees, Fayetteville, AR (USA)	
	9:7391	DOE/R6/10978—T1
FG46-79R610983	Jefferson Parish Water Dept., LA (USA)	
	9:7392	DOE/R6/10983—T1
FG46-79R610984	Carrizo Springs, City of, TX (USA)	
	9:7393	DOE/R6/10984—T1
FG46-79R610988	John Brown Univ., Siloam Springs, AR (USA). Div. of Engineering	
	9:7394	DOE/R6/10988—T1
FG46-79R610990	New Mexico Solar Energy Association, Santa Fe (USA)	
	9:7395	DOE/R6/10990—T1
FG46-79R610992	Oklahoma Electric Cooperative, Norman (USA)	
	9:7396	DOE/R6/10992—T1
FG46-79R610996	Southeastern Louisiana Univ., Hammond (USA). Coll. of Business	
	9:7397	DOE/R6/10996—T1
	Southeastern Louisiana Univ., Hammond (USA)	
	9:7435	DOE/R6/10996—T2
FG46-79R610998	Sunspace, Inc., Ada, OK (USA)	
	9:7398	DOE/R6/10998—T1
FG46-79R610999	Harambee, Inc., Oklahoma City, OK (USA)	
	9:7399	DOE/R6/10999—T1
FG46-80R611991	Walnut Fork Design, Builders, and Woodworking Co., Inc., Ozone, AR (USA)	
	9:7400	DOE/R6/11991—T1
FG46-80R611992	North Arkansas Community Coll., Harrison (USA)	
	9:7349	DOE/R6/11992—T1
FG46-80R611997	Henry (Joseph), Fayetteville, AR (USA)	
	9:7401	DOE/R6/11997—T1
FG46-80R612000	Kreul (Bernard H.), Nashville, AR (USA)	
	9:7402	DOE/R6/12000—T1
FG46-80R612024	Taos Solar Energy Association, NM (USA)	
	9:7403	DOE/R6/12024—T1
FG46-80R612027	Cassidy (Daniel J.), Cleveland, NM (USA)	
	9:7347	DOE/R6/12027—T1
FG46-80R612037	Woods (Ray A.), Fairview, OK (USA)	
	9:7769	DOE/R6/12037—T1
FG46-80R612038	Robison (John), Oklahoma City, OK (USA)	
	9:7404	DOE/R6/12038—T1
FG46-80R612040	Bohlmann (James W.), Collinsville, OK (USA)	
	9:7405	DOE/R6/12040—T1
FG46-80R612042	Garst (Perry), Quinton, OK (USA)	
	9:7406	DOE/R6/12042—T1
FG46-80R612044	Young (Fred L.), Midwest City, OK (USA)	
	9:7407	DOE/R6/12044—T1
FG46-80R612050	Ana-Lab Corp., Kilgore, TX (USA)	
	9:7436	DOE/R6/12050—T1
FG46-80R612051	Travis Elementary School, Odessa, TX (USA)	
	9:7408	DOE/R6/12051—T1
FG46-80R612052	Teske (C.E.), Lubbock, TX (USA)	
	9:7409	DOE/R6/12052—T1
FG46-80R612059	Caldwell (Phillip Mack), El Paso, TX (USA)	
	9:7410	DOE/R6/12059—T1
FG46-80R612064	Ochs (Greg), Austin, TX (USA)	
	9:7437	DOE/R6/12064—T1
FG46-80R612066	San Marcos, City of, TX (USA)	
	9:7411	DOE/R6/12066—T1
FG46-81R612322	New Mexico Univ., Albuquerque (USA). New Mexico Energy Research and Development Inst.	
	9:7412	DOE/R6/12322—T2
FG46-81R612325	Alamo Navajo School Board, Inc., Magdalena, NM (USA)	
	9:7413	DOE/R6/12325—T1
FM02-82FE55014	Great Plains Gasification Associates, Detroit, MI (USA)	
	9:7101	DOE/FE/55014—T6
NAS-7-100-955567	Spectrolab, Inc., Sylmar, CA (USA)	
	9:7355	DOE/JPL/955567—83/12
W-31-109-ENG-38	Argonne National Lab., IL (USA)	
	9:7092	CONF-8308151—1
	9:7136	CONF-831112—2
	Washington Univ., St. Louis, MO (USA)	
	9:7313	CONF-831106—19
	Argonne National Lab., IL (USA)	
	9:7351	ANL/CNSV—42
	Bechtel Group, Inc., San Francisco, CA (USA)	
	9:7469	CONF-840201—5
	Argonne National Lab., IL (USA)	
	9:7476	ANL—83-99
	9:7555	CONF-8310166—2
	9:7571	CONF-840113—2
	9:7581	CONF-831012—8
	9:7582	CONF-831012—9
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	9:7610	CONF-831047—120
	9:7611	CONF-831047—123
	9:7616	CONF-8310143—58
	9:7617	CONF-8310143—67
	9:7618	CONF-8310176—5
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	Illinois Univ., Urbana (USA)	
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	Argonne National Lab., IL (USA)	
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	9:7849	CONF-831012—10
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	9:8132	Solvent Extraction and Ion Exchange 1 NO. 3. 565-583 (1983).
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	Argonne National Lab., IL (USA)	
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	9:8598	CONF-840202—2
	Argonne National Lab., IL (USA)	
	9:8638	ANL/ER-TM—83-3
	9:8719	Journal of Chemical Physics 80 NO. 1. 63-69 (1 Jan 1984).
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	9:9067	CONF-8310226—1
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	9:9130	CONF-831203—41
	9:9190	ANL/MCS-TM—15
W-7405-ENG-26	**Oak Ridge National Lab., TN (USA)**	
	9:7084	ORNL—6008
	9:7088	CONF-830759—3
	9:7090	CONF-831239—2
	9:7093	CONF-8311109—2
	9:7105	DOE/NBM—4003400
	9:7117	ORNL/SGMP—83/2
	9:7118	ORNL/TM—8775
	9:7119	ORNL/TM—8777
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	Oak Ridge Gaseous Diffusion Plant, TN (USA)	
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	Oak Ridge National Lab., TN (USA)	
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	9:7493	NUREG/CR—3502
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	Oak Ridge Gaseous Diffusion Plant, TN (USA)	
	9:7542	K/OP—299-Pt.1
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	9:7548	CONF-8310143—15
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	9:7560	NUREG/CR—3482
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	9:7609	CONF-830816—49
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	9:7767	DOE/NBM—4004261
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	Kelvinator Compressor Co., Grand Rapids, MI (USA)	
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	Clemson Univ., SC (USA). Dept. of Civil Engineering	
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	Oak Ridge National Lab., TN (USA)	
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	Kollmorgen Corp., Radford, VA (USA)	
	9:7845	CONF-820727—6
	Oak Ridge National Lab., TN (USA)	
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	9:7918	ORNL—5995
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	Oak Ridge National Lab., TN (USA)	
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	Tennessee Univ., Knoxville (USA)	
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	Oak Ridge National Lab., TN (USA)	
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	9:9097	Physics of Fluids 27 NO. 1. 1-4 (Jan 1984).
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	General Dynamics Corp., San Diego, CA (USA). Convair Div.	
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	Oak Ridge National Lab., TN (USA)	
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	9:9131	CONF-831203—55-Draft
	Oak Ridge National Lab., TN (USA)	
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	9:9134	CONF-831203—64
	Los Alamos National Lab., NM (USA)	
	9:9135	CONF-831203—65
	Varian Associates, Inc., Palo Alto, CA (USA)	
	9:9136	CONF-831243—4
	9:9137	CONF-831245—2
	Oak Ridge National Lab., TN (USA)	
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	9:7628	LA-UR—83-3011
	9:7629	LA-UR—83-3026
	9:7630	LA-UR—83-3062
	9:7631	LA-UR—83-3116
	9:7632	LA-UR—83-3127
	9:7695	LA—9753-PR
	9:7898	LA-UR—83-3701
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	9:8262	LA-UR—83-3278
	9:8272	LA—9843-MS
	9:8309	LA—9904-MS
	9:8310	LA—9927-MS
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	9:8438	LA-UR—83-3349
	9:8439	LA-UR—83-3384
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	9:8586	LA-UR—83-3423
	9:8682	LA-UR—83-3215
	9:8683	LA-UR—83-3216
	9:8684	LA-UR—83-3704
	9:8700	LA-UR—83-3361
	Rice Univ., Houston, TX (USA)	
	9:8701	LA-UR—83-3368
	Los Alamos National Lab., NM (USA)	
	9:8702	LA-UR—83-3498
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	McDonnell Douglas Astronautics Co., St. Louis, MO (USA)	
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CONF-8105229-	(6. meeting of the section 2 of the advisory committee for the calibration standards of ionizing radiation measurement, Sevres, France, 5-7 May 1981)			
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CONF-8105230-	(5. meeting of the section 3 of the advisory committee for the calibration standards of ionizing radiation measurement, Sevres, France, 25-27 May 1981)			
	See CCEMRI-3-1981	DE83704133	MN -23	9:9042
CONF-8105231-	(Conference on nucleonic instruments and their use in the CSSR, Pribram, Czechoslovakia, 18-22 May 1981)			
	See INIS-mf-8584	DE84780044	MN -11	9:8426
CONF-8106309-	(6. meeting of the section 1 of the advisory committee for the calibration standards of ionizing radiation measurement, Sevres, France, 3-5 Jun 1981)			
	See CCEMRI-1-1981	DE83704130	MN -23	9:9040
CONF-8107117-	(9. session of the advisory committee for the calibration standards of ionizing radiation measurement, Sevres, France, 27-28 Jul 1981)			
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CONF-8109247-	(Summer school on particle physics, Gif-sur-Yvette, France, 7-11 Sep 1981)			
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CONF-8110302-	(2. seminar on physical metallurgy and heat treatments, Rio de Janeiro, Brazil, 1-2 Oct 1981)			
1	*See* INIS-BR-87	DE84700211	MN -25	9:7882
CONF-811147-	(International symposium on polarization phenomena at high energies, Dubna, USSR, 17-20 Nov 1981)			
	See JINR-D-1,2-82-27	DE84780046	MN -34D	9:8741
CONF-811161-	(Specialist meeting on fast neutron scattering on actinide nuclei, Paris, France, 23-25 Nov 1981)			
	See NEANDC-158-U	DE83704074	MN -34C	9:8972
CONF-8111183-	(Meeting on chimerism in irradiated dicotyledonous plants, Vienna, Austria, 30 Nov-4 Dec 1981)			
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CONF-811291-	(18. symposium on nuclear medicine, Reinhardsbrunn, German D.R., 7-11 Dec 1981)			
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CONF-820217-	(9. energy technology conference, Washington, DC, USA, 16-18 Feb 1982)			
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	Energy Technol. (Wash., D.C.), 9: 1391-1399(Jun 1982)			9:7731
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CONF-8203152-	(Meeting on metallic glasses, Augsburg, F.R. Germany, 3-5 Mar 1982)			
Abstr.	NTIS (US Sales Only), PC A05/MF A01	DE84770051	MN -25	9:8052
CONF-8205103-	(Workshop on physics at LEAR with low energy cooled antiprotons, Erice, Italy, 9-16 May 1982)			
10	*See* IPNO-TH-82-28	DE83704042	MN -34D	9:8754
11	*See* IPNO-TH-82-32	DE83704043	MN -34D	9:8755
CONF-8205228-	(25. ISA power instrumentation symposium on instrumentation in the power industry, Phoenix, AZ, USA, 24-26 May 1982)			
	Instrument Society of America, 67 Alexander Dr., P.O. Box 12277, Research Triangle Park, NC 27709			9:7468
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	Am. Soc. Mech. Eng., Pressure Vessels Piping Div., [Tech. Rep.] PVP, PVP-VOL-56: 55-78(1982)			9:8233
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34	*See* CEA-CONF-6622	DE83704108	MN -25	9:7842
CONF-820640-	(IEEE Computer Society conference, Las Vegas, NV, USA, 14-17 Jun 1982)			
2-Rev.	*See* LBL-14772-Rev.	DE84004238	MN -48	9:8615
CONF-820650-	(3. Japan/US HTGR safety technology seminar, Upton, NY, USA, 2-3 Jun 1982)			
Vol.1	*See* NUREG/CP-0045-Vol.1	DE84000514	MN -77	9:7635
CONF-8206221-	(IAWPR specialised seminar, Copenhagen, Denmark, 16-18 Jun 1982)			
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CONF-820718-	(21. international conference on high energy physics, Paris, France, 29 Jul-8 Aug 1982)			
48	*See* ISN-82-33	DE83704086	MN -34C	9:8757
CONF-820727-	(3. joint intermag-magnetism and magnetic materials conference, Montreal, Canada, 17-23 Jul 1982)			
6	NTIS, PC A02/MF A01	DE83015529	MN -25	9:7845
CONF-820797-	(International symposium on symmetries and properties of non-rigid molecules, Paris, France, 1-7 Jul 1982)			
1	*See* LYCEN-8224	DE83704055	MN -34D	9:8811
CONF-820814-	(17. Intersociety Energy Conversion Engineering conference, Los Angeles, CA, USA, 8-13 Aug 1982)			
	Proc., Intersoc. Energy Convers. Eng. Conf., 4: 1784-1789(Sep 1982)			9:7227
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	Proc., Intersoc. Energy Convers. Eng. Conf., 1: 278-283(Aug 1982)			9:7833
CONF-820836-	(NATO advanced study institute on radiation hydrodynamics, Munich, F.R. Germany, 2-13 Aug 1982)			
2	*See* UCRL-90009	DE84003193	MN -34	9:8687
CONF-820853-	(NATO conference on photophysics and photochemistry in the vacuum ultraviolet, Lake Geneva, WI, USA, 15-29 Aug 1982)			
Abstr.	NTIS, PC A16/MF A01; 1	DE83017399	MN -4	9:8184
CONF-820896-	(Nordic meeting on nuclear physics, Fuglso, Denmark, 16-20 Aug 1982)			
S-Summ.	*See* ISN-82-39	DE83704087	MN -34C	9:8932
CONF-8208161-	(6. international workshop on rare earth-cobalt permanent magnets and their applications, Baden, Austria, 31 Aug-2 Sep 1982)			
	See RCO-6	DE84700208	MN -25	9:7920
CONF-820927-	(57. AIME Society of Petroleum Engineers annual technical conference and exhibition, New Orleans, LA, USA, 26-29 Sep 1982)			
8	SPE, 6200 N. Central Expressway, PO Drawer 64706, Dallas, TX 75206		ND -92a	9:7231
CONF-820948-	(12. symposium on fusion technology, Juelich, F.R. Germany, 13-17 Sep 1982)			
15	NTIS, PC A02/MF A01	DE84004691	MN -20	9:9121
16	NTIS, PC A02/MF A01; 1	DE84004451	MN -20	9:9122
17	NTIS, PC A02/MF A01	DE84004449	MN -20	9:9123
CONF-820958-	(4. symposium on nuclear chemistry, radiochemistry and radiation chemistry, Mexico City, Mexico, 7-10 Sep 1982)			
Summ.	*See* INIS-mf-8536	DE84780043	MN -11	9:8193
CONF-820991-	(8. international workshop on weak interactions and neutrinos, Javea, Spain, 5-11 Sep 1982)			
4	*See* CENBG-8223	DE84750235	MN -34C	9:8850
5-Summ.	*See* CENBG-8222	DE84750236	MN -34C	9:8903
CONF-8209182-	(Heat pump modeling workshop, Oak Ridge, TN, USA, 22-23 Sep 1982)			
Suppl.	NTIS, PC A12/MF A01; 1	DE84000683	MN -95d	9:7762
CONF-8209185-	(Annual conference of the Austrian Physical Society, Graz, Austria, 22-24 Sep 1982)			
	See INIS-mf-8664	DE84700203	MN -34A	9:9049

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CONF-8209186-	(3. international symposium on magnetic anisotropy and coercivity in rare earth-transition metal alloys, Baden, Austria, 3 Sep 1982)			
	See RCO-6	DE84700208	MN -25	9:7920
CONF-821046-	(11. world conference of the International Nuclear Target Development Society, Seattle, WA, USA, 6-8 Oct 1982)			
5	*See* CEA-CONF-6515	DE83704100	MN -4	9:7841
CONF-821057-	(International conference on the impact of polarized neutrons on solid state chemistry and physics, Grenoble, France, 15-19 Oct 1982)			
6	*See* CEA-CONF-6633	DE83704109	MN -25	9:8019
CONF-821065-	(Topical meeting on nuclear fluid dynamics ICTP, Trieste, Italy, 11-15 Oct 1982)			
2	*See* IPNO-TH-82-42	DE83704070	MN -34C	9:9024
CONF-821089-	(6. international workshop on laser interaction and related plasma phenomena, Monterey, CA, USA, 25-29 Oct 1982)			
15	*See* NRL-MR-5219	DE84004027	MN -21	9:9156
CONF-8210183-	(CETAMA meeting on gas phase chromatography, Fontenay-aux-Roses, France, 21-22 Oct 1982)			
1	*See* CEA-CONF-6559	DE83704094	MN -4	9:8095
CONF-8210198-	(22. congress of radiologists of the GDR, Karl-Marx-Stadt, German D.R., 25-29 Oct 1982)			
Absts.	Karl-Marx-Stadt, Germany; Gesellschaft fuer Medizinische Radiologie der DDR (1982).			9:8617
CONF-8210221-	(IAEA specialist meeting on advances in structural analysis for LMFBR applications, Paris, France, 11-15 Oct 1982)			
	See CEA-N-2349	DE84750178	MN -79	9:7507
CONF-8210227-	(HUD/DOE district heating and cooling assessment program conference, St. Paul, MN, USA, 26-28 Oct 1982)			
Summs.	NTIS, PC A04/MF A01	DE84004717	MN -95d	9:7800
CONF-821107-	(6. international symposium on the scientific basis for radioactive waste management (Materials Research Society), Boston, MA, USA, 1-4 Nov 1982)			
58	NTIS, PC A02/MF A01	DE84003363	MN -25	9:8051
CONF-821108-	(Applied superconductivity conference, Knoxville, TN, USA, 30 Nov-3 Dec 1982)			
33	NTIS, PC A02/MF A01	DE84003373	MN -20b	9:9124
34	NTIS, PC A02/MF A01	DE84004678	MN -20b	9:9125
CONF-821111-	(29. national symposium of American Vacuum Society, Baltimore, MD, USA, 16-19 Nov 1982)			
26	NTIS, PC A03/MF A01	DE84004690	MN -20	9:9126
CONF-821143-	(High angular momentum properties of nuclei conference, Oak Ridge, TN, USA, 2-4 Nov 1982)			
13	NTIS, PC A02/MF A01; 1	DE84003277	MN -34	9:8936
CONF-821254-	(7. annual congress of the Brazilian Biophysics Society, Rio de Janeiro, Brazil, 15-17 Dec 1982)			
Summ.	*See* INIS-BR-78	DE83703947	MN -48	9:9071
CONF-821265-	(Symposium on the chemistry of plutonium, Kansas City, MO, USA, 1 Dec 1982)			
1	NTIS, PC A03/MF A01	DE84003672	MN -4	9:8154
CONF-821268-	(Tokyo Institute of Technology symposium on zirconia ceramics, Yokohama, Japan, 7 Dec 1982)			
1	NTIS, PC A02/MF A01	DE84004677	MN -25	9:8021
CONF-830117-	(21. international winter meeting on nuclear physics, Bormio, Italy, 24-29 Jan 1983)			
7	*See* CEA-CONF-6613	DE83704067	MN -34C	9:8984
8	*See* CEA-CONF-6614	DE83704068	MN -34C	9:8985
9	*See* CEA-CONF-6612	DE83704076	MN -34C	9:8871
10	*See* CEA-CONF-6619	DE83704077	MN -34C	9:8955
11	*See* CEA-CONF-6620	DE83704078	MN -34C	9:8956
12	*See* CEA-CONF-6621	DE83704079	MN -34C	9:8886
13	*See* CEA-CONF-6632	DE83704080	MN -34C	9:8848
CONF-830118-	(11. international workshop on gross properties of nuclei and nuclear excitations, Hirschegg, Austria, 17-22 Jan 1983)			
	See INIS-mf-8307	DE84780052	MN -34D	9:8834
CONF-830123-	(International Society for Optical Engineering (SPIE) conference, Los Angeles, CA, USA, 24-28 Jan 1983)			
4	*See* SAND-83-1582C	DE84004069	MN -4	9:8128
CONF-830203-	(IADC/SPE drilling conference, New Orleans, LA, USA, 20-23 Feb 1983)			
	Soc. Pet. Eng. AIME, Pap., IADC/SPE 11359: 41-46(Feb 1983)			9:7210
CONF-830205-	(Waste management conference, Tucson, AZ, USA, 27 Feb-3 Mar 1983)			
36	*See* CEA-CONF-6641	DE83704188	MN -70	9:7267
CONF-830213-	(10. energy technology conference, Washington, DC, USA, 28 Feb-2 Mar 1983)			
	Energy Technol. (Wash., D.C.), 10: 11-13(Jun 1983)			9:7705
CONF-830223-	(Wire chamber conference, Vienna, Austria, 15-18 Feb 1983)			
14	*See* LAL-83-01	DE84750221	MN -37	9:8444
15	*See* LAL-83-04	DE84750222	MN -37	9:8445
CONF-830308-	(American Insititute of Chemical Engineers national meeting, Houston, TX, USA, 27-31 Mar 1983)			
13	Institute of Gas Technology, 3424 South State Street, IIT Center, Chicago, IL 60616		MN -90c	9:7087

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CONF-830318-	(5. power plant dynamics control and testing symposium, Knoxville, TN, USA, 21-23 Mar 1983)			
7	*See* CEA-CONF-6717	DE84750237	MN -79p	9:7570
8	*See* CEA-CONF-6716	DE84750239	MN -78	9:7486
CONF-830381-	(Solid fuel heat technology symposium, Baltimore, MD, USA, 11 Mar 1983)			
	NTIS, PC A10/MF A01; 1	DE83017816	STD -95	9:7338
CONF-830390-	(US/Japanese seminar on physics of highly ionized ions produced in heavy ion collisions, Honolulu, HI, USA, 14-18 Mar 1983)			
2	NTIS, PC A02/MF A01	DE84003405	MN -34A	9:8704
CONF-8303104-	(4. Eurodata conference, Venice, Italy, 23-25 Mar 1983)			
1	*See* CEA-CONF-6705	DE84750238	MN -78	9:7485
CONF-830423-	(5. symposium on safeguards and nuclear material management, Versailles, France, 19-21 Apr 1983)			
14	*See* CEA-CONF-6719	DE84750240	MN -70	9:7268
CONF-830495-	(5. annual industrial energy conservation technology conference, Houston, TX, USA, 17-20 Apr 1983)			
2	*See* PNL-SA-11300	DE84004832	MN -95a	9:7793
CONF-8304101-	(7. American Society of Testing and Materials symposium on aquatic toxicology, Milwaukee, WI, USA, 17-19 Apr 1983)			
2	*See* UCRL-88644	DE84004884	MN -11	9:8631
CONF-8304142-	(7. international conference on meson spectroscopy, Upton, NY, USA, 14-16 Apr 1983)			
1	*See* SLAC-PUB-3243	DE84004600	MN -34D	9:8773
CONF-830514-	(Offshore technology conference, Houston, TX, USA, 2-5 May 1983)			
	Offshore Technol. Conf., 1: 173-180(May 1983)			9:8474
CONF-830563-	(Enlarged halden program group meeting, Loen, Norway, 23-28 May 1983)			
5	*See* PNL-SA-11381	DE84001907	MN -78	9:7568
CONF-8305140-	(Conference on instrumental activation analysis - IAA 83, Klucenice, Czechoslovakia, 30 May-3 Jun 1983)			
Abts.	*See* INIS-mf-8642	DE83704744	MN -4	9:8114
CONF-8305146-	(SLAC software working group meeting, Stanford, CA, USA, 20 May 1983)			
	NTIS, PC A03/MF A01; 1	DE83017557	MN -32	9:9194
CONF-830609-	(ANS annual meeting, Detroit, MI, USA, 12-17 Jun 1983)			
63	NTIS, PC A02/MF A01	DE84004038	MN -79p	9:7608
CONF-830610-	(Nevada Applied Ecology Group transuranics (and associated radionuclides) information conference, Las Vegas, NV, USA, 28-30 Jun 1983)			
3	NTIS, PC A02/MF A01	DE84003164	MN -11	9:8537
CONF-830617-	(76. annual meeting of the Air Pollution Control Association, Atlanta, GA, USA, 19-24 Jun 1983)			
15	IGT, 3424 South State St. IIT Center, Chicago, Ill 60616		MN -11	9:8506
CONF-830631-	(6. biennial wind energy conference, Minneapolis, MN, USA, 1-3 Jun 1983)			
13	*See* DOE/NASA/20320-56	DE84004144	STD -60	9:7466
CONF-830662-	(VDI Society of German Engineers conference on precipitation, Lindau, F.R. Germany, 7-10 Jun 1983)			
2	NTIS, PC A03/MF A01	DE84004014	MN -11	9:8507
CONF-8306135-	(Alternative fuels utilization contractors coordination meeting, Windsor, Ontario, Canada, 7-9 Jun 1983)			
Pt.1	NTIS, PC A04/MF A01	DE84003927	STD -96	9:7334
CONF-8306141-	(Conference on waves and stability in continuous media, Cosenza, Italy, 11 Jun 1983)			
1	NTIS, PC A02/MF A01	DE84003107	MN -25	9:7837
CONF-830706-	(13. international conference on the physics of electronic and atomic collisions (ICPEAC), Berlin, F.R. Germany, 27 Jul-2 Aug 1983)			
9	*See* DOE/ER/02408-214	DE84004052	MN -34A	9:8705
CONF-830710-	(7. international conference of radiation research, Amsterdam, Netherlands, 3-8 Jul 1983)			
13	NTIS, PC A02/MF A01	DE84004040	MN -48	9:8597
CONF-830719-	(American Physical Society meeting on shock waves in condensed media, Santa Fe, NM, USA, 18-21 Jul 1983)			
54	*See* UCRL-88976	DE84001426	MN -45	9:8482
CONF-830759-	(16. annual technical meeting of the International Metallographic Society, Calgary, Canada, 25-28 Jul 1983)			
3	NTIS, PC A02/MF A01	DE84003262	MN -90d	9:7088
CONF-830805-	(7. international conference on structural mechanics in reactor technology, Chicago, IL, USA, 22-26 Aug 1983)			
65	*See* SAND-83-1810C	DE84001784	MN -80	9:7649
CONF-830808-	(International solvent extraction conference, Denver, CO, USA, 26 Aug-2 Sep 1983)			
14	Institute of Gas Technology, 3424 South State Street, IIT Center, Chicago, IL 60616		MN -4	9:8099
CONF-830811-	(Conference on quantitative NDE, Santa Cruz, CA, USA, 7-12 Aug 1983)			
19	*See* PNL-SA-11396	DE84004839	MN -80	9:7562
CONF-830812-	(18. intersociety energy conversion engineering conference, Orlando, FL, USA, 21-26 Aug 1983)			
	Proc., Intersoc. Energy Convers. Eng. Conf., 1: 411-416(Aug 1983)			9:7124

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	Proc., Intersoc. Energy Convers. Eng. Conf., 1: 118-124(Aug 1983)			9:7173
	Proc., Intersoc. Energy Convers. Eng. Conf., 1: 125-130(Aug 1983)			9:7174
	Proc., Intersoc. Energy Convers. Eng. Conf., 1: 13-18(Aug 1983)			9:7258
	Proc., Intersoc. Energy Convers. Eng. Conf., 1: 61-68(Aug 1983)			9:7591
	Proc., Intersoc. Energy Convers. Eng. Conf., 1: 131-137(Aug 1983)			9:7735
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	Proc., Intersoc. Energy Convers. Eng. Conf., 1: 155-162(Aug 1983)			9:7738
	Proc., Intersoc. Energy Convers. Eng. Conf., 1: 222-226(Aug 1983)			9:7746
	Proc., Intersoc. Energy Convers. Eng. Conf., 1: 240-244(Aug 1983)			9:7747
	Proc., Intersoc. Energy Convers. Eng. Conf., 1: 198-201(Aug 1983)			9:7750
	Proc., Intersoc. Energy Convers. Eng. Conf., 1: 202-207(Aug 1983)			9:7751
	Proc., Intersoc. Energy Convers. Eng. Conf., 1: 186-191(Aug 1983)			9:7752
	Proc., Intersoc. Energy Convers. Eng. Conf., 1: 192-197(Aug 1983)			9:7753
CONF-830814-	(186. national meeting of the American Chemical Society, Washington, DC, USA, 28 Aug-2 Sep 1983)			
Vol.2	Am. Chem. Soc., Div. Pet. Chem., Prepr., 28: No. 5, 1203-1207(Sep 1983)			9:7170
Vol.2	Am. Chem. Soc., Div. Pet. Chem., Prepr., 28: No. 5, 1139-1144(Sep 1983)			9:7246
Vol.2	Am. Chem. Soc., Div. Pet. Chem., Prepr., 28: No. 5, 1261-1271(Sep 1983)			9:7337
CONF-830816-	(International meeting on light-water reactor severe accident evaluation, Cambridge, MA, USA, 28 Aug-1 Sep 1983)			
49	NTIS, PC A02/MF A01	DE84003313	MN -78	9:7609
CONF-830831-	(CRYPTO '83 conference, Santa Barbara, CA, USA, 21-24 Aug 1983)			
3	NTIS, PC A02/MF A01	DE84004996	MN -32	9:9193
CONF-830841-	(Cryogenic engineering conference and international cryogenic materials conference, Colorado Springs, CO, USA, 15-19 Aug 1983)			
28	*See* LBL-16536	DE84004343	MN -25	9:7900
CONF-830847-	(Energy resource management '83, San Francisco, CA, USA, 23-27 Aug 1983)			
7	NTIS, PC A02/MF A01	DE84003402	MN -96	9:7834
CONF-830859-	(National meeting of the American Institute of Chemical Engineers, Denver, CO, USA, 28-31 Aug 1983)			
11	*See* LBL-16275	DE84004883	MN -4	9:8156
12	IGT, 3424 South State St., Chicago, IL 60616		MN -91	9:7223
CONF-830887-	(Joint meeting of American Crystallographic Association and Denver X-ray conference, Snowmass, CO, USA, 1 Aug 1983)			
2	*See* SAND-83-1062C	DE84004065	MN -25	9:8027
CONF-830897-	(NRC workshop on spent fuel/cladding reactions during dry storage, Gaithersburg, MD, USA, 17 Sep-18 Aug 1983)			
4	*See* PNL-SA-11124	DE84002473	MN -86	9:7262
CONF-8308101-	(International symposium on lepton and photon interactions at high energies, Ithaca, NY, USA, 4-9 Sep 1983)			
6	*See* FERMILAB-CONF-83/75-EXP	DE84003185	MN -34D	9:8747
CONF-8308110-	(6. international congress on photosynthesis, Brussels, Belgium, 1-6 Aug 1983)			
7	NTIS, PC A02/MF A01	DE84003602	MN -4	9:8568
CONF-8308125-	(3. international conference on recent progress in many-body theories, Altenberg, F.R. Germany, 29 Aug-3 Sep 1983)			
4	NTIS, PC A02/MF A01	DE84004023	MN -34	9:9046
CONF-8308129-	(NATO Advanced Study Institute conference on non-equilibrium cooperative phenomena in physics and related fields, Madrid, Spain, 1-11 Aug 1983)			
1	*See* UCRL-89884	DE84001241	MN -45	9:8484
CONF-8308131-	(3. international conference on physics in collision, Como, Italy, 31 Aug-2 Sep 1983)			
2	*See* SLAC-PUB-3248	DE84003861	MN -34D	9:8774
CONF-8308149-	(Conference on glass in planetary and geological phenomena, Alfred, NY, USA, 14-18 Aug 1983)			
1	NTIS, PC A02/MF A01	DE84003385	MN -25	9:8053
CONF-8308151-	(Coal combustion application working group meeting (CCAWG), La Jolla, CA, USA, 24-25 Aug 1983)			
1	NTIS, PC A03/MF A01	DE84003688	MN -89	9:7092
CONF-830905-	(Joint power generation conference, Indianapolis, IN, USA, 25-29 Sep 1983)			
9	NTIS MF A01; 2	DE84001850	MN -79k	9:7531

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11	*See* HEDL-SA-2966	DE84001497	MN -79a	9:7534
CONF-830908-	(11. European conference on controlled fusion and plasma physics, Aachen, F.R. Germany, 5-9 Sep 1983)			
7	NTIS, PC A02/MF A01; 1	DE84003312	MN -20g	9:9074
CONF-830942-	(3. topical meeting on fusion reactor materials, Albuquerque, NM, USA, 19-23 Sep 1983)			
69	NTIS, PC A02/MF A01	DE84003639	MN -20c	9:7846
71	*See* HEDL-SA-2889-FP	DE84003951	MN -20c	9:9147
72	NTIS, PC A02/MF A01	DE84003997	MN -20c	9:7847
75	*See* HEDL-SA-2999-FP	DE84004823	MN -20c	9:9149
76	*See* HEDL-SA-2904-FP	DE84004933	MN -20c	9:7881
77	NTIS, PC A02/MF A01	DE84003412	MN -20c	9:7848
CONF-830972-	(20. congress of the International Association of Hydraulic Research, Moscow, USSR, 5-9 Sep 1983)			
1	*See* LA-UR-83-3368	DE84003832	MN -34B	9:8701
CONF-830990-	(Solar thermal research workshop, Atlanta, GA, USA, 7-8 Sep 1983)			
4	*See* LBL-16748	DE84003043	MN -62	9:7439
CONF-830996-	(Annual international conference on the high-temperature gas-cooled reactor, San Diego, CA, USA, 29-30 Sep 1983)			
1	NTIS, PC A02/MF A01	DE84003310	MN -77	9:7496
CONF-8309104-	(International Society of Exploration Geophysicists meeting, Las Vegas, NV, USA, 11-15 Sep 1983)			
3	NTIS, PC A03/MF A01	DE84003872	MN -11	9:8648
CONF-8309118-	(Topical meeting on free electron generation of extreme ultraviolet coherent radiation, Upton, NY, USA, 19-22 Sep 1983)			
5	*See* LBL-16744	DE84004627	MN -21	9:8366
CONF-8309130-	(14. international technical meeting on air pollution modeling and its applications, Copenhagen, Denmark, 27-30 Sep 1983)			
4	NTIS, PC A02/MF A01	DE84003638	MN -11	9:8508
CONF-8309168-	(3. international conference on ultra-relativistic nucleus-nucleus collisions, Upton, NY, USA, 26-30 Sep 1983)			
4	*See* LBL-16835	DE84004173	MN -34D	9:8367
5	*See* LBL-16800	DE84004341	MN -34D	9:8810
CONF-8309172-	(IAU symposium on observational tests of stellar evolution theory, Geneva, Switzerland, 12-16 Sep 1983)			
4	*See* LA-UR-83-3216	DE84003785	MN -34B	9:8683
5	*See* LA-UR-83-3215	DE84003787	MN -34B	9:8682
CONF-8309188-	(NATO conference on the application of new technologies to improve the delivery of aerospace and defense information, Ottawa, Canada, 14-15 Sep 1983)			
1	NTIS, PC A02/MF A01	DE84900451	MN -13	9:9216
CONF-8309194-	(Biomass liquefaction experts meeting, Sherbrooke, Quebec, Canada, 29-30 Sep 1983)			
1	*See* PNL-SA-11807	DE84003344	MN -61a	9:7332
CONF-831012-	(International symposium on use and development of low and medium flux research reactors, Cambridge, MA, USA, 17-19 Oct 1983)			
4	*See* LA-UR-83-3404	DE84003849	MN -80	9:7585
5	*See* LA-UR-83-3405	DE84003825	MN -80	9:7586
8	NTIS, PC A02/MF A01	DE84003642	MN -80	9:7581
9	NTIS, PC A02/MF A01	DE84003629	MN -80	9:7582
10	NTIS, PC A02/MF A01; 1	DE84003648	MN -80	9:7849
CONF-831015-	(Nuclear science symposium, San Francisco, CA, USA, 19-21 Oct 1983)			
26	*See* LBL-15051	DE84003961	MN -80	9:7633
27	*See* LBL-15960	DE84004957	MN -32	9:8446
28	*See* LBL-15942	DE84004635	MN -37	9:8466
29	*See* LBL-15983	DE84004166	MN -34D	9:8365
CONF-831025-	(26. ORNL-DOE conference on analytical chemistry in energy technology, Knoxville, TN, USA, 11-13 Oct 1983)			
28	*See* MLM-3115(OP)	DE84002826	MN -25	9:8125
CONF-831047-	(American Nuclear Society winter meeting, San Francisco, CA, USA, 30 Oct-4 Nov 1983)			
88	*See* HEDL-SA-2965-FP	DE84001498	MN -79a	9:7623
98	*See* HEDL-SA-2965-S	DE84001681	MN -79a	9:7624
107	*See* EGG-M-14183	DE84003025	MN -80	9:8915
120	NTIS, PC A02/MF A01	DE84003577	MN -80	9:7610
121	*See* HEDL-SA-2906-FP	DE84003889	MN -79g	9:7254
122	*See* HEDL-SA-2903-FP	DE84003857	MN -80	9:7253
123	NTIS, PC A02/MF A01	DE84004028	MN -79p	9:7611
124	*See* HEDL-SA-2915-FP	DE84003864	MN -79g	9:8217
CONF-831049-	(International seminar on indoor exposure to natural radiation and related risk assessment, Capri, Italy, 3-5 Oct 1983)			
2	*See* PNL-SA-11571	DE84003957	MN -48	9:8616
CONF-831065-	(Meeting of the Nuclear Physics Division of the American Physical Society, Notre Dame, IN, USA, 13-15 Oct 1983)			
1	*See* BNL-33824	DE84002864	MN -34D	9:8828
CONF-831069-	(5. conference on atmospheric radiation, Baltimore, MD, USA, 31 Oct-3 Nov 1983)			
3	*See* PNL-SA-11561	DE84004831	MN -11	9:8520
CONF-8310104-	(Specialists meeting on yields and decay data of fission product nuclides, Upton, NY, USA, 24-27 Oct 1983)			
7	*See* LA-UR-83-3531	DE84004372	MN -34C	9:8970

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8	*See* UCRL-89914	DE84004819	MN -34B	9:8686
CONF-8310111-	(11. DOE annual compatibility meeting, Livermore, CA, USA, 18-20 Oct 1983)			
8	*See* MLM-3113-OP	DE84002833	MN -45	9:8478
9	*See* MLM-3117-OP	DE84002840	MN -45	9:8480
10	*See* MLM-3114(OP)	DE84002841	MN -45	9:8479
CONF-8310121-	(SPE annual technical conference, San Francisco, CA, USA, 5-8 Oct 1983)			
7	*See* LBL-16269	DE84004347	MN -66a	9:7458
CONF-8310143-	(11. NRC water reactor safety research information meeting, Gaithersburg, MD, USA, 14-28 Oct 1983)			
10	*See* LA-UR-83-3011	DE84001701	MN -78	9:7628
11	NTIS, PC A02/MF A01	DE84001971	MN -78	9:7612
12	NTIS, PC A02/MF A01	DE84001939	MN -78	9:7613
14	NTIS, PC A02/MF A01	DE84001973	MN -80	9:7614
15	NTIS, PC A02/MF A01; 1	DE84001968	MN -80	9:7548
16	*See* LA-UR-83-3026	DE84001749	MN -78	9:7629
18-DRAFT	NTIS, PC A02/MF A01; 1	DE84002062	MN -80	9:7615
19	*See* LA-UR-83-3116	DE84001746	MN -78	9:7631
20	*See* LA-UR-83-3127	DE84001744	MN -78	9:7632
21	*See* LA-UR-83-3062	DE84001729	MN -78	9:7630
35	*See* EGG-M-21183	DE84002213	MN -78	9:7620
57	NTIS, PC A02/MF A01; 1	DE84003292	MN -80	9:7554
58	NTIS, PC A03/MF A01	DE84003551	MN -78	9:7616
60	NTIS, PC A02/MF A01	DE84003459	MN -78	9:7851
63	NTIS, PC A02/MF A01; 1	DE84003357	MN -78	9:7572
64	*See* SAND-83-1911C	DE84003209	MN -80	9:7651
65	NTIS, PC A02/MF A01	DE84004018	MN -78	9:7852
66	*See* EGG-M-21083	DE84002215	MN -78	9:7480
67	NTIS, PC A02/MF A01; 1	DE84004037	MN -80	9:7617
71	*See* SAND-83-1868C	DE84004068	MN -80	9:7650
CONF-8310148-	(Los Alamos/CEA high explosives and detonation physics conference, Paris, France, 3-6 Oct 1983)			
10	*See* LA-UR-83-2645	DE84001201	MN -45	9:8476
CONF-8310159-	(Joint symposium on compatibility of plastics/materials with explosives, propellents and pyrotechnics, Lake Ozark, MO, USA, 31 Oct-2 Nov 1983)			
6	*See* MLM-3119(OP)	DE84002827	MN -45	9:8481
7	*See* MLM-3111(OP)	DE84002828	MN -45	9:8477
CONF-8310166-	(54. shock and vibration symposium, Pasadena, CA, USA, 18-19 Oct 1983)			
2	NTIS, PC A03/MF A01	DE84003618	MN -80	9:7555
CONF-8310173-	(Nuclear explosives design conference, Los Alamos, NM, USA, 15-17 Oct 1983)			
2	*See* UCRL-89664	DE84002465	MN -35	9:8483
CONF-8310176-	(International meeting on reduced enrichment for research and test reactors, Tokai, Japan, 24-31 Oct 1983)			
5	NTIS, PC A02/MF A01	DE84003680	MN -80	9:7618
CONF-8310179-	(8. international symposium on polynuclear aromatic hydrocarbons, Columbus, OH, USA, 26-28 Oct 1983)			
5	NTIS, PC A02/MF A01	DE84003278	MN -41	9:8509
CONF-8310183-	(International symposium on ceramic components for engines, Hakone, Japan, 17-21 Oct 1983)			
3	NTIS, PC A02/MF A01	DE84003401	MN -96	9:7825
CONF-8310205-	(TMS-AIME fall meeting, Philadelphia, PA, USA, 2-6 Oct 1983)			
3	NTIS, PC A02/MF A01	DE84004006	MN -78	9:7853
5	*See* DOE/ER/10942-6	DE84004430	MN -25	9:7867
6	*See* DOE/ER/10942-5	DE84004432	MN -25	9:7866
CONF-8310206-	(Water Pollution Control Federation annual conference, Atlanta, GA, USA, 2-6 Oct 1983)			
2	IGT, 3424 South State St., Chicago, IL 60616		MN -95e	9:7782
CONF-8310220-	(International specialty conference on the meteorology of acidic deposition, Hartford, CT, USA, 16-19 Oct 1983)			
3	NTIS, PC A02/MF A01	DE84003446	MN -11	9:8502
CONF-8310221-	(Biology and characterization of cultured vertebrate cell lines symposium, Bethesda, MD, USA, 2-5 Oct 1983)			
1	NTIS, PC A02/MF A01	DE84003574	MN -48	9:8569
CONF-8310226-	(National Science Foundation conference on chemically based computer designs, Los Angeles, CA, USA, 24-28 Oct 1983)			
1	NTIS, PC A02/MF A01	DE84003996	MN -32	9:9067
CONF-8310228-	(6. Soviet national conference on neutron physics, Kiev, USSR, 10-14 Oct 1983)			
1	NTIS, PC A02; 3	DE84003708	MN -34C	9:8957
CONF-8310229-	(Chapman conference on magnetic reconnection, Los Alamos, NM, USA, 3-7 Oct 1983)			
1	*See* LA-UR-83-3498	DE84004335	MN -34B	9:8702
2	*See* LA-UR-83-3704	DE84004413	MN -34B	9:8684
5	*See* LA-UR-83-3361	DE84003833	MN -34B	9:8700
6	NTIS, PC A02/MF A01	DE84004695	MN -20g	9:9138
CONF-8310231-	(International conference on hematopoietic cellular proliferation, Upton, NY, USA, 6-7 Oct 1983)			
3	*See* BNL-33795	DE84002881	MN -48	9:8596

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CONF-8310236-	(Symposium of Northeastern accelerator personnel, Rochester, NY, USA, 3-5 Oct 1983)			
1	*See* BNL-33738	DE84002693	MN -28	9:8318
CONF-8310240-	(Symposium on air pollution and the productivity of the forest, Washington, DC, USA, 4-5 Oct 1983)			
2	NTIS, PC A02/MF A01	DE84003320	MN -11	9:8627
CONF-831106-	(Topical meeting on safeguards technology - the process safeguards interface, Hilton Head Island, SC, USA, 28 Nov-1 Dec 1983)			
5	*See* LA-UR-83-3392	DE84003836	MN -15	9:7314
19	NTIS, PC A02/MF A01	DE84004001	MN -15	9:7313
20	*See* PNL-SA-11782	DE84004838	MN -11	9:8543
21	*See* BNL-33947	DE84004626	MN -15	9:7311
22	*See* BNL-33949	DE84004631	MN -15	9:7312
CONF-831112-	(Coal technology '83 - international coal utilization convention, Houston, TX, USA, 15-17 Nov 1983)			
2	NTIS, PC A02/MF A01; 1	DE84004032	MN -90i	9:7136
CONF-831115-	(6. world energy engineering congress, Atlanta, GA, USA, 29 Nov-1 Dec 1983)			
1	NTIS, PC A02/MF A01	DE84004578	MN -95d	9:7761
CONF-831130-	(Technical committee meeting on inertial confinement fusion research, Osaka, Japan, 7-11 Nov 1983)			
2	*See* DOE/DP/40124-10	DE84003691	MN -21	9:9139
CONF-831147-	(National atmospheric deposition program, Knoxville, TN, USA, 7-10 Nov 1983)			
1	*See* PNL-SA-11798	DE84004844	MN -11	9:8521
CONF-831166-	(3. worldwide synfuels symposium, Washington, DC, USA, 1-3 Nov 1983)			
1	GDC, Inc., 10 W. 35th St., Chicago, IL 60616		MN -90c	9:7089
CONF-831174-	(Materials Research Society annual meeting, Boston, MA, USA, 14-17 Nov 1983)			
42	*See* LA-UR-83-3278	DE84003784	MN -34	9:8262
48	*See* UCRL-89994	DE84004885	MN -25	9:7969
49	NTIS, PC A02/MF A01	DE84004041	MN -25	9:7850
50	*See* BNL-NUREG-33990	DE84004736	MN -70	9:7266
51	*See* LBL-16690	DE84004882	MN -70	9:8196
52	*See* LBL-16774	DE84004636	MN -25	9:8067
53	*See* PNL-SA-11436	DE84004845	MN -25	9:7919
54	*See* LBL-16884	DE84004632	MN -25	9:8068
57	*See* UCRL-89475	DE84004288	MN -70	9:7294
59	*See* UCRL-89477	DE84004818	MN -70	9:7295
CONF-831175-	(6. international conference on nondestructive evaluation in the nuclear industry, Zurich, Switzerland, 27 Nov-2 Dec 1983)			
1	*See* HEDL-SA-2867-FP	DE84003950	MN -78	9:7622
CONF-831180-	(3. international symposium on the production and neutralization of negative ions and beams, Upton, NY, USA, 14-18 Nov 1983)			
10	*See* DOE/ER/40001-36	DE84004836	MN -34A	9:8707
11	*See* LBL-16871	DE84004342	MN -20g	9:9154
12	*See* LBL-16866	DE84004324	MN -20	9:9153
CONF-831195-	(International congress on applications of lasers and electro-optics, Los Angeles, CA, USA, 14-17 Nov 1983)			
4	*See* LA-UR-83-3701	DE84004414	MN -38	9:7898
5	*See* K/TS-11,232	DE84004264	MN -22	9:7252
CONF-8311109-	(Direct coal liquefaction contractor's review conference, Pittsburgh, PA, USA, 16-17 Nov 1983)			
2	NTIS, PC A03/MF A01	DE84003284	MN -90d	9:7093
CONF-8311116-	(Deburring and surface conditioning conference, Orlando, FL, USA, 7-14 Nov 1983)			
1	*See* PNL-SA-11743	DE84004850	MN -38	9:8226
CONF-8311119-	(Pu isotopic and metals exchange meeting, Miamisburg, OH, USA, 2 Nov 1983)			
1	*See* UCRL-90102	DE84004360	MN -10	9:8129
CONF-8311127-	(IASTED energy symposium, Orlando, FL, USA, 9-11 Nov 1983)			
1	*See* LA-UR-83-3229	DE84003778	MN -21	9:9152
CONF-831203-	(10. symposium on fusion engineering, Philadelphia, PA, USA, 5-9 Dec 1983)			
19	*See* UCRL-89321	DE84003734	MN -20	9:9168
28	*See* UCRL-89232	DE84003737	MN -20b	9:9167
30	*See* UCRL-90008	DE84003747	MN -20b	9:9171
33	NTIS, PC A02/MF A01; 1	DE84004011	MN -20f	9:9127
34	NTIS, PC A02/MF A01; 1	DE84004012	MN -20c	9:9128
35	NTIS, PC A02/MF A01	DE84004003	MN -20f	9:9129
36	*See* UCRL-90058	DE84003647	MN -20	9:9172
37	*See* UCRL-89979	DE84004853	MN -20	9:9170
38	*See* UCRL-89370	DE84004851	MN -20b	9:9169
40	*See* HEDL-SA-2923	DE84003856	MN -20d	9:9148
41	NTIS, PC A02/MF A01	DE84004033	MN -20d	9:9130
42	*See* GTFR-45	DE84004610	MN -20d	9:9146
50	*See* EGG-M-10383	DE84004230	MN -20f	9:9144
55-Draft	NTIS, PC A02/MF A01; 1	DE84004692	MN -20	9:9131
61-Draft	NTIS, PC A02/MF A01; 1	DE84004455	MN -20a	9:9132
63	NTIS, PC A02/MF A01	DE84004648	MN -20b	9:9133

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64	NTIS, PC A02/MF A01; 1	DE84004543	MN -20b	9:9134
65	NTIS, PC A02/MF A01	DE84004464	MN -20a	9:9135
66	NTIS, PC A02/MF A01	DE84004424	MN -20d	9:9075
CONF-831217-	(5. civilian radioactive waste management information meeting, Washington, DC, USA, 12-15 Dec 1983)			
2	*See* SAND-83-2592C	DE84004422	MN -71	9:7263
CONF-831239-	(Systems simulation symposium of fossil fuel conversion processes, Morgantown, WV, USA, 6-8 Dec 1983)			
1	NTIS, PC A03/MF A01; 1	DE84004647	MN -90a	9:7128
2	NTIS, PC A02/MF A01	DE84004437	MN -90d	9:7090
CONF-831243-	(International electron device meeting, Washington, DC, USA, 5-7 Dec 1983)			
4	NTIS, PC A02/MF A01	DE84004573	MN -20a	9:9136
CONF-831245-	(8. international conference on infrared and millimeter waves, Miami Beach, FL, USA, 12-17 Dec 1983)			
2	NTIS, PC A02/MF A01; 1	DE84004586	MN -20a	9:9137
CONF-831254-	(Agricultural electronics - 1983 and beyond conference, Chicago, IL, USA, 11-12 Dec 1983)			
2	*See* LA-UR-83-3423	DE84003820	MN -48	9:8586
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1	*See* LA-UR-83-3713	DE84004358	MN -34A	9:8716
CONF-840112-	(IEEE Power Engineering Society winter meeting, Dallas, TX, USA, 29 Jan-3 Feb 1984)			
1	*See* BNL-33608	DE84000536	MN -97a	9:7472
CONF-840113-	(Symposium on space nuclear power systems, Albuquerque, NM, USA, 10-13 Jan 1984)			
2	NTIS, PC A02/MF A01	DE84003991	MN -2	9:7571
CONF-840119-	(5. international symposium on finite element methods in flow problems, Austin, TX, USA, 23-26 Jan 1984)			
2	*See* DP-MS-83-25	DE84003477	MN -80	9:7556
CONF-840133-	(11. aerospace sciences meeting, Reno, NV, USA, 9-12 Jan 1984)			
3	NTIS, PC A02/MF A01; 1	DE84003761	MN -33	9:8497
CONF-840201-	(ASME energy sources technology conference and exhibition, New Orleans, LA, USA, 12-16 Feb 1984)			
1	NTIS, PC A03/MF A01	DE84001649	MN -90d	9:7091
2	NTIS, PC A03/MF A01	DE84003014	MN -93	9:7725
3	NTIS, PC A02/MF A01; 1	DE84003624	MN -93	9:7755
4	NTIS, PC A02/MF A01	DE84003646	MN -90f	9:7732
5	NTIS, PC A02/MF A01	DE84003675	MN -90f	9:7469
CONF-840202-	(17. midyear topical meeting of the Health Physics Society, Pasco, WA, USA, 5-9 Feb 1984)			
1	*See* LA-UR-83-3384	DE84003842	MN -15	9:8439
2	NTIS, PC A02/MF A01	DE84003590	MN -41	9:8598
3	*See* LA-UR-83-3409	DE84003821	MN -37	9:8441
4	*See* LA-UR-83-3398	DE84003824	MN -41	9:8440
5	*See* LA-UR-83-3349	DE84003829	MN -46	9:8438
6	*See* LA-UR-83-3329	DE84003794	MN -15	9:8498
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8	*See* LA-UR-83-3530	DE84004371	MN -46	9:8442
9	*See* LA-UR-83-3593	DE84004317	MN -46	9:8443
10	*See* LA-UR-83-3588	DE84004318	MN -46	9:8499
CONF-840245-	(6. symposium on management of uranium mill tailings, low-level waste, and hazardous waste, Fort Collins, CO, USA, 1-3 Feb 1984)			
1	*See* PNL-SA-11610	DE84003261	MN -70	9:7307
CONF-840247-	(Ahesion Society annual meeting, Jacksonville, FL, USA, 13-15 Feb 1984)			
1	NTIS, PC A02/MF A01; 1	DE84003759	MN -4	9:8042
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1	*See* LA-UR-83-3290	DE84003783	MN -32	9:9202
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DOE/R4/10142-T1	NTIS, PC A02/MF A01	DE84000285	MN -95d	9:7384
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DOE/R6/10971-T1	NTIS, PC A03/MF A01; 1	DE84003451	MN -59	9:7388
DOE/R6/10973-T1	NTIS, PC A02/MF A01	DE84003494	MN -59a	9:7389
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DOE/R6/10978-T1	NTIS, PC A03/MF A01	DE84002966	MN -59b	9:7391
DOE/R6/10983-T1	NTIS, PC A06/MF A01; 1	DE84002968	MN -59b	9:7392
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DOE/R6/10988-T1	NTIS, PC A03/MF A01	DE84002970	MN -59a	9:7394
DOE/R6/10990-T1	NTIS, PC A02/MF A01	DE84003533	MN -59	9:7395
DOE/R6/10992-T1	NTIS, PC A02/MF A01; 1	DE84003531	MN -59c	9:7396
DOE/R6/10996-T1	NTIS, PC A02/MF A01	DE84003492	MN -59b	9:7397
T2	NTIS, PC A05/MF A01; 1	DE84003138	MN -59c	9:7435
DOE/R6/10998-T1	NTIS, PC A02/MF A01; 1	DE84003549	MN -59a	9:7398

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DOE/R6/11992-T1	NTIS, PC A04/MF A01; 1	DE84003420	MN -58c	9:7349
DOE/R6/11997-T1	NTIS, PC A02/MF A01; 1	DE84003235	MN -61b	9:7401
DOE/R6/12000-T1	NTIS, PC A03/MF A01; 1	DE84003537	MN -59c	9:7402
DOE/R6/12024-T1	NTIS, PC A02/MF A01; 1	DE84003132	MN -59c	9:7403
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DOE/R6/12037-T1	NTIS, PC A02/MF A01	DE84002505	MN -59a	9:7769
DOE/R6/12038-T1	NTIS, PC A02/MF A01; 1	DE84002432	MN -59a	9:7404
DOE/R6/12040-T1	NTIS, PC A05/MF A01; 1	DE84003532	MN -59	9:7405
DOE/R6/12042-T1	NTIS, PC A02/MF A01; 1	DE84003453	MN -59a	9:7406
DOE/R6/12044-T1	NTIS, PC A02/MF A01; 1	DE84003449	MN -59a	9:7407
DOE/R6/12050-T1	NTIS, PC A02/MF A01	DE84003126	MN -59c	9:7436
DOE/R6/12051-T1	NTIS, PC A03; 3	DE84002967	MN -59a	9:7408
DOE/R6/12052-T1	NTIS, PC A02/MF A01	DE84003144	MN -59a	9:7409
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DOE/R6/12064-T1	NTIS, PC A02/MF A01; 1	DE84003123	MN -59c	9:7437
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DOE/RL/01830-T10	NTIS, PC A07/MF A01; 1	DE84002189	MN -90d	9:7827
T13	NTIS, PC A03/MF A01	DE84002185	MN -96	9:7828
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DP-1656	NTIS, PC A03/MF A01	DE84004298	STD -10	9:7256
DP-MS-83-12-Rev.1	NTIS, PC A02/MF A01	DE84004083	MN -11	9:8513
83-25	NTIS, PC A02/MF A01	DE84003477	MN -80	9:7556
DP-tr-51-A	NTIS, PC A02/MF A01; 1	DE84003038	MN -4	9:8137
54	NTIS, PC A02/MF A01	DE84003960	MN -4	9:7259
DSN-563	*See* CEA-CONF-6622	DE83704108	MN -25	9:7842
DTH-LV-123	NTIS (US Sales Only), PC A03/MF A01	DE84750083	MN -59	9:7415
DTH-LV-MEDD-133	NTIS (US Sales Only), PC A05/MF A01	DE84750084	MN -59c	9:7438
EDF-81H406133	NTIS (US Sales Only), PC A05/MF A01	DE83704137	MN -38	9:8251
82H406487	NTIS (US Sales Only), PC A02/MF A01	DE83704138	MN -38	9:8252
82H406492	NTIS (US Sales Only), PC A04/MF A01	DE83704189	MN -70	9:7272
82H406614	NTIS (US Sales Only), PC A03/MF A01	DE83704139	MN -38	9:8253
EFI-515(2) -82	NTIS (US Sales Only), PC A02/MF A01	DE83704194	MN -32	9:8746
525(12) -82	NTIS (US Sales Only), PC A02/MF A01	DE83704082	MN -34C	9:8852
EFI-TR-2856	NTIS (US Sales Only), PC A03/MF A01	DE84750118	MN -92	9:8283

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EGG-EA-				
6467	NTIS, PC A02/MF A01	DE84004232	MN -2	9:7619
EGG-HS-				
6378	NTIS, PC A04/MF A01	DE84004948	MN -41	9:8371
EGG-IS-				
6281-Rev.1	NTIS, PC A06/MF A01; 1	DE84004235	MN -38	9:9199
EGG-M-				
10383	NTIS, PC A02/MF A01	DE84004230	MN -20f	9:9144
14183	NTIS, PC A02/MF A01	DE84003025	MN -80	9:8915
21083	NTIS, PC A02/MF A01	DE84002215	MN -78	9:7480
21183	NTIS, PC A02/MF A01	DE84002213	MN -78	9:7620
EGG-PBS-				
6479	NTIS, PC A03/MF A01; 1	DE84004236	MN -41	9:8528
EGG-REP-				
6440	NTIS, PC A08/MF A01; 1	DE84004234	MN -70	9:7273
EGG-SE-				
6451	NTIS, PC A04/MF A01	DE84005188	MN -95d	9:7786
6464	NTIS, PC A02/MF A01	DE84004233	MN -80	9:7583
EGG-TMI-				
6443	NTIS, PC A04/MF A01; 1	DE84004945	MN -78	9:7488
EML-				
420	NTIS, PC A02/MF A01	DE84004439	STD -11	9:8673
ENDF-				
333	*See* ORNL/TM-8203	DE84002265	STD -79d	9:9036
335	*See* ORNL/RSIC-46	DE84004071	MN -13	9:9035
ENICO-				
1116	NTIS, PC A04/MF A01; 1	DE84004891	MN -11	9:7274
EPA-				
600/ D-83-093	*See* PB-83-247437			9:8519
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EPRI-AP-				
3283	NTIS, PC A15/MF A01	DE84003890	MN -20	9:9145
ESG-DOE-				
13419	NTIS, PC A07/MF A01	DE84004745	MN -90a	9:7130
EUR-				
8348-EN	ECIS, 2100 M St., NW, Suite 707, Washington, DC 20037		ND -32	9:7680
8360-Vol.1-2-EN	Commission of the European Communities, Luxembourg			9:7140
8382-EN	Commission of the European Communities, Luxembourg			9:7108
8632-FR	European Community Information Service (ECIS), 2100 M Street N.W., Suite 707, Washington, DC 20037		ND -2	9:8180
FE-				
2315-92	*See* DOE/ET/10532-T14	DE84001650	STD -90d	9:7095
2893-124	*See* DOE/ET/10069-T78	DE84004669	MN -90d	9:7094
FEI-				
1175	NTIS (US Sales Only), PC A02/MF A01	DE83704110	MN -25	9:7875
1189	NTIS (US Sales Only), PC A02/MF A01	DE83704064	MN -46	9:9030
1256	NTIS (US Sales Only), PC A02/MF A01	DE83704140	MN -38	9:8254
1276	NTIS (US Sales Only), PC A02/MF A01	DE83704154	MN -80	9:7489
1278	NTIS (US Sales Only), PC A02/MF A01	DE83704141	MN -38	9:8255
1303	NTIS (US Sales Only), PC A02/MF A01	DE83704111	MN -25	9:7876
1330	NTIS (US Sales Only), PC A02/MF A01	DE83704142	MN -38	9:8256
1351	NTIS (US Sales Only), PC A02/MF A01	DE83704143	MN -38	9:8257
FERMILAB-CONF-				
83/ 75-EXP	NTIS, PC A03/MF A01; 1	DE84003185	MN -34D	9:8747
FERMILAB/TM-				
1139-A	NTIS, PC A02/MF A01	DE84003317	MN -28	9:8296
1140	NTIS, PC A02/MF A01; 1	DE84003376	MN -28	9:8323
1141	NTIS, PC A02/MF A01	DE84003588	MN -28	9:8287
1142	NTIS, PC A02/MF A01	DE84003267	MN -28	9:8324
1143	NTIS, PC A02/MF A01; 1	DE83015734	MN -28	9:8288
1144	NTIS, PC A02/MF A01; 1	DE84003609	MN -28	9:8823
1145	NTIS, PC A03/MF A01	DE84004980	MN -41	9:9044
1146	NTIS, PC A02/MF A01	DE84003667	MN -28	9:7324
1147	NTIS, PC A02/MF A01	DE84003591	MN -28	9:8325
1208	NTIS, PC A03/MF A01	DE84004780	MN -28	9:8326
1223	NTIS, PC A02/MF A01	DE84004779	MN -28	9:8360
1224	NTIS, PC A03/MF A01; 1	DE84004922	MN -28	9:8361
1227	NTIS, PC A06/MF A01	DE84004778	MN -28	9:8362
1234	NTIS, PC A02/MF A01; 1	DE84005161	MN -28	9:8297
FRNC-TH-				
1149	NTIS (US Sales Only), PC A05/MF A01	DE84700204	MN -34C	9:8958
1154	NTIS (US Sales Only), PC A07/MF A01	DE84750257	MN -62	9:8463
1160(Pt.1)	NTIS (US Sales Only), PC A07/MF A01	DE84700209	MN -25	9:7877
1160(Pt.2)	NTIS (US Sales Only), PC A08/MF A01	DE84700210	MN -25	9:7878
1194	NTIS (US Sales Only), PC A08/MF A01	DE84750224	MN -34A	9:8708
GA-A-				
16261	*See* PB-83-249433			9:8158
16508	NTIS, PC A06/MF A01	DE84002559	STD -77	9:7621
17110	NTIS, PC A06/MF A01	DE84003974	STD -77	9:7497
GAO/GGD-				
83-92	General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760		MN -13	9:7662
GAO/RCED-				
83-212	General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760		MN -90c	9:7177

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GEAP-				
23773	NTIS, PC A08/MF A01	DE84004977	MN -78	9:7481
GEND-				
037	NTIS, PC A06/MF A01	DE84003469	STD -78	9:7575
GJ/TMC-				
07(83)	NTIS, PC A04/MF A01	DE84004369	STD -70A	9:8102
GRC-CR-				
83-1128	*See* AD-A-131265/1			9:8210
GTFR-				
45	NTIS, PC A02/MF A01	DE84004610	MN -20d	9:9146
GULF-GA-A-				
12608	NTIS, PC A22/MF A01; 1	DE83018296	MN -33	9:7537
HEDL-				
7418	NTIS, PC A02/MF A01	DE84004593	MN -25	9:7879
7419	NTIS, PC A02/MF A01	DE84004594	MN -25	9:7880
HEDL-SA-				
2867-FP	NTIS, PC A02/MF A01	DE84003950	MN -78	9:7622
2889-FP	NTIS, PC A02/MF A01	DE84003951	MN -20c	9:9147
2903-FP	NTIS, PC A02/MF A01	DE84003857	MN -80	9:7253
2904-FP	NTIS, PC A02/MF A01	DE84004933	MN -20c	9:7881
2906-FP	NTIS, PC A02/MF A01	DE84003889	MN -79g	9:7254
2915-FP	NTIS, PC A02/MF A01	DE84003864	MN -79g	9:8217
2923	NTIS, PC A02/MF A01	DE84003856	MN -20d	9:9148
2960	NTIS, PC A03/MF A01; 1	DE84001496	MN -79k	9:7533
2965-FP	NTIS, PC A02/MF A01; 1	DE84001498	MN -79a	9:7623
2965-S	NTIS, PC A02/MF A01	DE84001681	MN -79a	9:7624
2966	NTIS, PC A02/MF A01; 1	DE84001497	MN -79a	9:7534
2999-FP	NTIS, PC A02/MF A01	DE84004823	MN -20c	9:9149
IAE-				
3504/ 3	NTIS (US Sales Only), PC A02/MF A01	DE83704104	MN -4	9:8186
IAEA-TECDOC-				
289	NTIS (US Sales Only), PC A04/MF A01	DE84780053	MN -48	9:8599
ICTIS/M-				
0164	Coal Research Association of New Zealand, Wellington			9:7165
0166	Lanchester Polytechnic, Coventry, England			9:7160
0167	Lanchester Polytechnic, Coventry, England			9:7161
IFE/KR/E-				
82/ 007	NTIS (US Sales Only), PC A02/MF A01	DE84750113	MN -11	9:8628
82/ 008	NTIS (US Sales Only), PC A03/MF A01	DE84750114	MN -11	9:8514
IFVE-OEA-				
82-140	NTIS (US Sales Only), PC A02/MF A01	DE83704195	MN -32	9:8372
IFVE-OEF-				
82-146	NTIS (US Sales Only), PC A02/MF A01	DE83704144	MN -38	9:8218
IFVE-OEIPE-				
82-51	NTIS (US Sales Only), PC A02/MF A01	DE83704060	MN -34D	9:8748
82-145	NTIS (US Sales Only), PC A02/MF A01	DE83704059	MN -34D	9:8749
IFVE-OI-				
82-34	NTIS (US Sales Only), PC A02/MF A01	DE83704146	MN -28	9:8327
IFVE-OMVT-				
82-92	NTIS (US Sales Only), PC A02/MF A01	DE83704147	MN -28	9:8289
IFVE-ONF-				
82-40	NTIS (US Sales Only), PC A02/MF A01	DE83704061	MN -34D	9:8750
IFVE-OUNE-				
82-72	NTIS (US Sales Only), PC A02/MF A01	DE83704148	MN -28	9:8328
IKE-				
7-6	NTIS (US Sales Only), PC A05/MF A01	DE84750054	MN -11	9:8285
IN2P3-				
81-1	NTIS (US Sales Only), PC A13/MF A01; 1	DE84750206	MN -34D	9:9054
INIS-BR-				
59	NTIS (US Sales Only), PC A06/MF A01	DE83703949	MN -78	9:7576
61	NTIS (US Sales Only), PC A02/MF A01	DE83703958	MN -41	9:8373
78	NTIS (US Sales Only), PC A07/MF A01	DE83703947	MN -48	9:9071
87	NTIS (US Sales Only), PC A02/MF A01	DE84700211	MN -25	9:7882
89	NTIS (US Sales Only), PC A06/MF A01	DE84700205	MN -4	9:8112
90	NTIS (US Sales Only), PC A08/MF A01	DE84700212	MN -25	9:7883
94	NTIS (US Sales Only), PC A05/MF A01	DE84700207	MN -25	9:8025
INIS-mf-				
8194	NTIS (US Sales Only), PC A02/MF A01	DE83703962	MN -70	9:7275
8218	NTIS (US Sales Only), PC A04/MF A01	DE83703950	MN -48	9:8578
8219	NTIS (US Sales Only), PC A06/MF A01	DE83703953	MN -48	9:8579
8220	NTIS (US Sales Only), PC A04/MF A01	DE83703951	MN -48	9:8580
8226	NTIS (US Sales Only), PC A03/MF A01	DE83703963	MN -70	9:7276
8228	NTIS (US Sales Only), PC A02/MF A01	DE83703948	MN -41	9:7709
8230	NTIS (US Sales Only), PC A05/MF A01	DE83703960	MN -37	9:8669
8232	NTIS (US Sales Only), PC A06/MF A01	DE83703955	MN -38	9:7470
8233	NTIS (US Sales Only), PC A06/MF A01	DE83703959	MN -41	9:8374
8234	NTIS (US Sales Only), PC A07/MF A01	DE83703961	MN -37	9:8261
8238	NTIS (US Sales Only), PC A08/MF A01	DE83703952	MN -48	9:8581
8277	NTIS (US Sales Only), PC A02/MF A01	DE83704767	MN -2	9:7277
8279	NTIS (US Sales Only), PC A04/MF A01	DE83704768	MN -2	9:7710
8280	NTIS (US Sales Only), PC A04/MF A01	DE83704766	MN -2	9:7699
8281	NTIS (US Sales Only), PC A12/MF A01	DE83704765	MN -70	9:7278
8290	NTIS (US Sales Only), PC A10/MF A01	DE84700206	MN -4	9:8187

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8291	NTIS (US Sales Only), PC A07/MF A01	DE84700202	MN -34A	9:8060
8297	NTIS (US Sales Only), PC A05/MF A01	DE84700213	MN -25	9:7884
8299	NTIS (US Sales Only), PC A11/MF A01	DE84780049	MN -34D	9:8833
8307	NTIS (US Sales Only), PC A11/MF A01	DE84780052	MN -34D	9:8834
8312	NTIS (US Sales Only), PC A15/MF A01	DE84700214	MN -34B	9:8501
8536	NTIS (US Sales Only), PC A05/MF A01	DE84780043	MN -11	9:8193
8573	NTIS (US Sales Only), PC A12/MF A01	DE83704191	MN -2	9:7279
8583	NTIS (US Sales Only), PC A04/MF A01	DE83703956	MN -80	9:7482
8584	NTIS (US Sales Only), PC A09/MF A01	DE84780044	MN -11	9:8426
8585	NTIS (US Sales Only), PC A02/MF A01	DE84780045	MN -48	9:8614
8587	NTIS (US Sales Only), PC A03/MF A01	DE83703964	MN -2	9:7700
8588	NTIS (US Sales Only), PC A02/MF A01	DE83703957	MN -80	9:7584
8592	NTIS (US Sales Only), PC A08/MF A01	DE83703954	MN -23	9:8475
8603	NTIS (US Sales Only), PC A04/MF A01	DE83704769	MN -2	9:7474
8630	NTIS (US Sales Only), PC A14/MF A01	DE83704739	MN -34D	9:8789
8631	NTIS (US Sales Only), PC A06/MF A01	DE83704735	MN -34B	9:8678
8633	NTIS (US Sales Only), PC A05/MF A01	DE83704736	MN -34B	9:8679
8636	NTIS (US Sales Only), PC A06/MF A01	DE83704740	MN -34C	9:8911
8642	NTIS (US Sales Only), PC A04/MF A01	DE83704744	MN -4	9:8114
8648	NTIS (US Sales Only), PC A07/MF A01	DE83704737	MN -34B	9:8680
8652	NTIS (US Sales Only), PC A06/MF A01	DE83704741	MN -34C	9:8882
8655	NTIS (US Sales Only), PC A06/MF A01	DE83704764	MN -37	9:8465
8656	NTIS (US Sales Only), PC A07/MF A01	DE83704742	MN -34C	9:8709
8659	NTIS (US Sales Only), PC A07/MF A01	DE83704743	MN -34C	9:8912
8660	NTIS (US Sales Only), PC A06/MF A01	DE83704738	MN -34B	9:8681
8664	NTIS (US Sales Only), PC A05/MF A01	DE84700203	MN -34A	9:9049
IOM-TM-				
83-15	Institute of Occupational Medicine, Edinburgh, Scotland			9:7186
IPNO-DRE-				
83-05	NTIS (US Sales Only), PC A02/MF A01	DE84750217	MN -34C	9:8883
IPNO-T-				
83-02	NTIS (US Sales Only), PC A09/MF A01; 1	DE84750229	MN -34C	9:8931
IPNO-TH-				
82-16	NTIS (US Sales Only), PC A02/MF A01	DE83704069	MN -34C	9:8796
82-28	NTIS (US Sales Only), PC A02/MF A01	DE83704042	MN -34D	9:8754
82-32	NTIS (US Sales Only), PC A02/MF A01	DE83704043	MN -34D	9:8755
82-42	NTIS (US Sales Only), PC A02/MF A01	DE83704070	MN -34C	9:9024
82-47	NTIS (US Sales Only), PC A02/MF A01	DE83704071	MN -34C	9:8845
ISN-				
82-07	NTIS (US Sales Only), PC A03/MF A01	DE83704083	MN -34C	9:8913
82-18	NTIS (US Sales Only), PC A06/MF A01	DE83704072	MN -34C	9:8835
82-25	NTIS (US Sales Only), MF A01; 2	DE84750223	MN -34C	9:8846
82-27	NTIS (US Sales Only), PC A02/MF A01	DE83704084	MN -34C	9:8756
82-28	NTIS (US Sales Only), PC A02/MF A01	DE83704085	MN -34C	9:8900
82-33	NTIS (US Sales Only), PC A02/MF A01	DE83704086	MN -34C	9:8757
82-35	NTIS (US Sales Only), PC A02/MF A01	DE83704073	MN -34C	9:8865
82-39	NTIS (US Sales Only), PC A02/MF A01	DE83704087	MN -34C	9:8932
82-46	*See* LAPP-EXP-82-05	DE83704093	MN -34C	9:8770
ITEP-				
21(1982)	NTIS (US Sales Only), PC A02/MF A01	DE83704065	MN -46	9:9034
47(1982)	NTIS (US Sales Only), PC A03/MF A01	DE83704089	MN -34C	9:8933
52(1982)	NTIS (US Sales Only), PC A03/MF A01	DE83704159	MN -78	9:7491
136(1982)	NTIS (US Sales Only), PC A02/MF A01	DE83704088	MN -34C	9:8866
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43(1982)	NTIS (US Sales Only), PC A02/MF A01	DE83704044	MN -34D	9:8797
45(1982)	NTIS (US Sales Only), PC A04/MF A01	DE83704045	MN -34D	9:8798
67(1982)	NTIS (US Sales Only), PC A02/MF A01	DE83704090	MN -34C	9:8934
75(1982)	NTIS (US Sales Only), PC A02/MF A01	DE83704046	MN -34D	9:8799
76(1982)	NTIS (US Sales Only), PC A02/MF A01	DE83704047	MN -34D	9:8800
77(1982)	NTIS (US Sales Only), PC A02/MF A01	DE83704048	MN -34D	9:8801
97(1982)	NTIS (US Sales Only), PC A02/MF A01	DE83704049	MN -34D	9:8802
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709	NTIS (US Sales Only), PC A03/MF A01	DE84750093	MN -64	9:7381
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207-82-002	*See* AD-A-131275/0			9:9120
JAERI-M-				
82-050	NTIS (US Sales Only), PC A06/MF A01	DE83704196	MN -32	9:7627
82-051	NTIS (US Sales Only), PC A06/MF A01	DE83704096	MN -4	9:8123
82-056	NTIS (US Sales Only), PC A08/MF A01	DE83704197	MN -32	9:8437
82-058	NTIS (US Sales Only), PC A04/MF A01	DE83704198	MN -32	9:7498
82-064	NTIS (US Sales Only), PC A04/MF A01	DE83704199	MN -32	9:7492
82-066	NTIS (US Sales Only), PC A04/MF A01	DE83704200	MN -32	9:9150
82-069	NTIS (US Sales Only), PC A02/MF A01	DE83704157	MN -80	9:7566
82-071	NTIS (US Sales Only), PC A04/MF A01	DE83704201	MN -32	9:7535
82-074	NTIS (US Sales Only), PC A03/MF A01	DE83704097	MN -4	9:8124
82-083	NTIS (US Sales Only), PC A04/MF A01	DE83704202	MN -32	9:7549
82-084	NTIS (US Sales Only), PC A04/MF A01	DE83704161	MN -79	9:7536
82-085	NTIS (US Sales Only), PC A03/MF A01	DE83704160	MN -77	9:7499
82-087	NTIS (US Sales Only), PC A02/MF A01	DE83704098	MN -4	9:8174
82-096	NTIS (US Sales Only), PC A06/MF A01	DE83704091	MN -34C	9:8969
JINR-				
D-1,2-82-27	NTIS (US Sales Only), PC A15/MF A01	DE84780046	MN -34D	9:8741
R-2-82-200	NTIS (US Sales Only), PC A02/MF A01	DE83704050	MN -34D	9:8867
R-2-82-263	NTIS (US Sales Only), PC A02/MF A01	DE83704051	MN -34D	9:8806
R-2-82-271	NTIS (US Sales Only), PC A02/MF A01	DE83704052	MN -34D	9:8824

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R-2-82-712	NTIS (US Sales Only), PC A02/MF A01	DE83704053	MN -34D	9:8807
R-9-82-785	NTIS (US Sales Only), PC A02/MF A01	DE83704150	MN -28	9:8298
R-11-82-702	NTIS (US Sales Only), PC A02/MF A01	DE83704149	MN -28	9:8299
R-15-82-519	NTIS (US Sales Only), PC A02/MF A01	DE83704092	MN -34C	9:8884
JINR-R-				
6-82-616	NTIS (US Sales Only), PC A02/MF A01	DE83704102	MN -4	9:8194
11-82-710	NTIS (US Sales Only), PC A02/MF A01	DE83704155	MN -80	9:7550
12-82-529	NTIS (US Sales Only), PC A02/MF A01	DE83704101	MN -4	9:8195
JPL-PUB-				
83-60-Vol.1	*See* DOE/JPL-1060-61-Vol.1	DE84003926	STD -62e	9:7379
83-60-Vol.2	*See* DOE/JPL-1060-61-Vol.2	DE84003929	STD -62e	9:7380
JTI-				
48	*See* NE-EO-83-9	DE84750101	MN -61a	9:7362
Juel-Spes-				
197	NTIS (US Sales Only), PC A02/MF A01; 1	DE84750053	MN -90c	9:7109
K/CSD-				
18	NTIS, PC A04/MF A01	DE84004355	STD -32	9:8734
K/OP-				
299-Pt.1	NTIS, PC A05/MF A01	DE84004905	MN -86	9:7542
299-Pt.2	NTIS, PC A05/MF A01	DE84004906	MN -86	9:7257
K/TS-				
11,232	NTIS, PC A02/MF A01	DE84004264	MN -22	9:7252
KC-				
82/ 01d	NTIS (US Sales Only), PC A03/MF A01	DE84750081	MN -25	9:7897
KHM-TR-				
50	NTIS (US Sales Only), PC A04/MF A01	DE84750091	MN -90i	9:7141
LA-				
9487-MS-Vol.2	NTIS, PC A04/MF A01	DE84003703	STD -33A	9:7328
9753-PR	NTIS, PC A04/MF A01	DE84003702	STD -34	9:7695
9843-MS	NTIS, PC A03/MF A01	DE84004477	STD -32	9:8272
9889-MS	NTIS, PC A02/MF A01	DE84004533	STD -28	9:8352
9892-MS	NTIS, PC A02/MF A01	DE84003556	STD -20g	9:9151
9904-MS	NTIS, PC A02/MF A01	DE84004480	STD -28	9:8309
9927-MS	NTIS, PC A02/MF A01	DE84004534	STD -28	9:8310
LA-tr-				
83-23	NTIS, PC A02/MF A01	DE84002582	MN -80	9:8456
83-30	NTIS, PC A02/MF A01	DE84004259	MN -4	9:8171
LA-UR-				
83-2645	NTIS, PC A02/MF A01	DE84001201	MN -45	9:8476
83-3011	NTIS, PC A02/MF A01; 1	DE84001701	MN -78	9:7628
83-3026	NTIS, PC A02/MF A01	DE84001749	MN -78	9:7629
83-3062	NTIS, PC A03/MF A01	DE84001729	MN -78	9:7630
83-3116	NTIS, PC A02/MF A01	DE84001746	MN -78	9:7631
83-3127	NTIS, PC A02/MF A01; 1	DE84001744	MN -78	9:7632
83-3215	NTIS, PC A02/MF A01	DE84003787	MN -34B	9:8682
83-3216	NTIS, PC A02/MF A01; 1	DE84003785	MN -34B	9:8683
83-3229	NTIS, PC A02/MF A01	DE84003778	MN -21	9:9152
83-3278	NTIS, PC A02/MF A01	DE84003784	MN -34	9:8262
83-3290	NTIS, PC A02/MF A01	DE84003783	MN -32	9:9202
83-3329	NTIS, PC A02/MF A01	DE84003794	MN -15	9:8498
83-3349	NTIS, PC A02/MF A01	DE84003829	MN -46	9:8438
83-3361	NTIS, PC A03/MF A01	DE84003833	MN -34B	9:8700
83-3368	NTIS, PC A02/MF A01; 1	DE84003832	MN -34B	9:8701
83-3384	NTIS, PC A02/MF A01	DE84003842	MN -15	9:8439
83-3392	NTIS, PC A02/MF A01; 1	DE84003836	MN -15	9:7314
83-3398	NTIS, PC A02/MF A01	DE84003824	MN -41	9:8440
83-3404	NTIS, PC A02/MF A01	DE84003849	MN -80	9:7585
83-3405	NTIS, PC A02/MF A01	DE84003825	MN -80	9:7586
83-3409	NTIS, PC A02/MF A01	DE84003821	MN -37	9:8441
83-3423	NTIS, PC A02/MF A01	DE84003820	MN -48	9:8586
83-3498	NTIS, PC A02/MF A01; 1	DE84004335	MN -34B	9:8702
83-3530	NTIS, PC A02/MF A01	DE84004371	MN -46	9:8442
83-3531	NTIS, PC A03/MF A01	DE84004372	MN -34C	9:8970
83-3588	NTIS, PC A02/MF A01	DE84004318	MN -46	9:8499
83-3593	NTIS, PC A02/MF A01	DE84004317	MN -46	9:8443
83-3630	NTIS, PC A02/MF A01	DE84004313	MN -46	9:8500
83-3701	NTIS, PC A03/MF A01; 1	DE84004414	MN -38	9:7898
83-3704	NTIS, PC A02/MF A01; 1	DE84004413	MN -34B	9:8684
83-3713	NTIS, PC A03/MF A01; 1	DE84004358	MN -34A	9:8716
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83-01	NTIS (US Sales Only), PC A02/MF A01; 1	DE84750221	MN -37	9:8444
83-04	NTIS (US Sales Only), PC A02/MF A01	DE84750222	MN -37	9:8445
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83-05	NTIS (US Sales Only), PC A03/MF A01	DE84750220	MN -28	9:8311
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82-05	NTIS (US Sales Only), PC A02/MF A01	DE83704093	MN -34C	9:8770
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82-01	NTIS (US Sales Only), PC A04/MF A01	DE83704054	MN -34D	9:8825
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66	NTIS (US Sales Only), PC A02/MF A01	DE84750219	MN -34D	9:8808
68	NTIS (US Sales Only), PC A02/MF A01	DE84750218	MN -34D	9:8809
71	NTIS (US Sales Only), PC A02/MF A01	DE84750234	MN -34D	9:8829
LBL-				
13657	NTIS, PC A03/MF A01	DE84004344	MN -25	9:7899
14772-Rev.	NTIS, PC A04/MF A01	DE84004238	MN -48	9:8615

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15051	NTIS, PC A02/MF A01	DE84003961	MN -80	9:7633
15731	*See* DOE/TIC-11616	DE83013074	STD -32	9:9198
15942	NTIS, PC A02/MF A01	DE84004635	MN -37	9:8466
15960	NTIS, PC A02/MF A01	DE84004957	MN -32	9:8446
15983	NTIS, PC A02/MF A01	DE84004166	MN -34D	9:8365
16269	NTIS, PC A02/MF A01	DE84004347	MN -66a	9:7458
16275	NTIS, PC A04/MF A01	DE84004883	MN -4	9:8156
16536	NTIS, PC A02/MF A01	DE84004343	MN -25	9:7900
16690	NTIS, PC A02/MF A01	DE84004882	MN -70	9:8196
16702	NTIS, PC A08/MF A01	DE84002915	MN -32	9:8735
16744	NTIS, PC A02/MF A01	DE84004627	MN -21	9:8366
16748	NTIS, PC A02/MF A01	DE84003043	MN -62	9:7439
16774	NTIS, PC A02/MF A01	DE84004636	MN -25	9:8067
16800	NTIS, PC A03/MF A01	DE84004341	MN -34D	9:8810
16811	NTIS, PC A13/MF A01	DE84004958	MN -48	9:8572
16824	*See* SLAC-PUB-3243	DE84004600	MN -34D	9:8773
16835	NTIS, PC A02/MF A01	DE84004173	MN -34D	9:8367
16839	NTIS, PC A07/MF A01	DE84004638	MN -25	9:8026
16866	NTIS, PC A02/MF A01; 1	DE84004324	MN -20	9:9153
16871	NTIS, PC A02/MF A01; 1	DE84004342	MN -20g	9:9154
16884	NTIS, PC A02/MF A01	DE84004632	MN -25	9:8068
16892	NTIS, PC A08/MF A01	DE84004351	MN -4	9:8717
16897	NTIS, PC A11/MF A01; 1	DE84004881	MN -25	9:7901
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5102	NTIS, PC A02/MF A01	DE84004960	MN -13	9:9189
LMSC-D-				
878374	*See* DOE/MC/19299-12	DE84002400	MN -90b	9:7103
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82-02	NTIS (US Sales Only), PC A02/MF A01	DE84750233	MN -34C	9:9025
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8224	NTIS (US Sales Only), PC A02/MF A01	DE83704055	MN -34D	9:8811
8290	NTIS (US Sales Only), PC A02/MF A01	DE84750231	MN -37	9:8447
8303	NTIS (US Sales Only), PC A02/MF A01	DE84750230	MN -34D	9:8831
8306	NTIS (US Sales Only), PC A02/MF A01; 1	DE84750232	MN -34D	9:8826
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64	NTIS, PC A08/MF A01	DE84003700	STD -90b	9:7131
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2855	*See* NUREG/CR-2078	DE84004160	MN -15	9:7315
3111(OP)	NTIS, PC A02/MF A01	DE84002828	MN -45	9:8477
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3114(OP)	NTIS, PC A02/MF A01; 1	DE84002841	MN -45	9:8479
3115(OP)	NTIS, PC A02/MF A01	DE84002826	MN -25	9:8125
3117-OP	NTIS, PC A02/MF A01	DE84002840	MN -45	9:8480
3119(OP)	NTIS, PC A03/MF A01; 1	DE84002827	MN -45	9:8481
3127	NTIS, PC A02/MF A01	DE84004294	STD -25	9:8126
MLM-MU-				
83-71-0002	NTIS, PC A07/MF A01; 1	DE84004352	MN -90d	9:7110
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69	NTIS (US Sales Only), PC A02/MF A01	DE84750086	MN -11	9:8533
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83W42-Vol.2	NTIS, PC A09/MF A01	DE84004984	MN -90d	9:7111
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83532	*See* DOE/NASA/20320-56	DE84004144	STD -60	9:7466
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310	NTIS, PC A05/MF A01	DE84004904	MN -4	9:8127
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83-1690	NTIS, PC A19/MF A01	DE83017361	STD -20b	9:9155
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1983-1	NTIS (US Sales Only), PC A03/MF A01	DE84750092	MN -61a	9:7357
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83-1	NTIS (US Sales Only), PC A02/MF A01	DE84750098	MN -61a	9:7358
83-4	NTIS (US Sales Only), PC A02/MF A01	DE84750099	MN -61a	9:7359
83-5	NTIS (US Sales Only), PC A02/MF A01	DE84750100	MN -61a	9:7360
83-7	NTIS (US Sales Only), PC A06/MF A01	DE84750105	MN -61a	9:7361
83-8	NTIS (US Sales Only), PC A07/MF A01; 1	DE84750110	MN -61a	9:8562
83-9	NTIS (US Sales Only), PC A04/MF A01	DE84750101	MN -61a	9:7362
83-10	NTIS (US Sales Only), PC A06/MF A01	DE84750102	MN -61a	9:7363

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83-3	NTIS (US Sales Only), PC A03/MF A01; 1	DE84750111	MN -61a	9:8535
83-6	NTIS (US Sales Only), PC A05/MF A01; 1	DE84750103	MN -61a	9:7364
NE-SBT-				
82-32	NTIS (US Sales Only), PC A05/MF A01; 1	DE84750106	MN -90b	9:7166
83-7	NTIS (US Sales Only), PC A10/MF A01; 1	DE84750109	MN -69	9:7172
83-12	NTIS (US Sales Only), PC A07/MF A01; 1	DE84750108	MN -90	9:7178
83-18	NTIS (US Sales Only), PC A04/MF A01; 1	DE84750104	MN -90b	9:7167
NE-VIND-				
83-12	NTIS (US Sales Only), PC A03/MF A01	DE84750107	MN -60	9:7467
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10	Australian Government Publications, Canberra			9:7715
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158-U	NTIS (US Sales Only), PC A11/MF A01	DE83704074	MN -34C	9:8972
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6(521)	NTIS (US Sales Only), PC A02/MF A01	DE83704203	MN -32	9:7567
18(533)	NTIS (US Sales Only), PC A02/MF A01	DE83704162	MN -79	9:7634
NLH/IJ/M-				
122	NTIS (US Sales Only), PC A02/MF A01	DE84750119	MN -61a	9:7787
NMRC-				
83-01	NTIS, PC A09/MF A01	DE84900498	MN -38	9:8209
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3770155	NTIS (US Sales Only), PC A08/MF A01; 1	DE83770155	MN -95e	9:7788
3770156	NTIS (US Sales Only), PC A06/MF A01; 1	DE83770156	MN -90a	9:7112
3770157	NTIS (US Sales Only), PC A05/MF A01; 1	DE83770157	MN -88	9:7162
3770158	Eidgenoessische Technische Hochschule, Zurich (Switzerland). Inst. fuer Hochbauforschung; 1		ND -95d	9:7770
3770159	NTIS (US Sales Only), PC A03/MF A01; 1	DE83770159	MN -98F	9:7664
3770160	NTIS (US Sales Only), PC A02/MF A01	DE83770160	MN -13	9:7693
3770161	NTIS (US Sales Only), PC A07/MF A01; 1	DE83770161	MN -97a	9:7473
3770162	NTIS (US Sales Only), PC A04/MF A01	DE83770162	MN -58a	9:7350
3770163	NTIS (US Sales Only), PC A03/MF A01; 1	DE83770163	MN -11	9:8515
3770164	NTIS (US Sales Only), PC A03/MF A01	DE83770164	MN -92b	9:7215
3770165	NTIS (US Sales Only), PC A07/MF A01; 1	DE83770165	MN -88	9:8281
3770166	NTIS (US Sales Only), PC A03/MF A01; 1	DE83770166	MN -88	9:7179
3770167	NTIS (US Sales Only), PC A06/MF A01; 11	DE83770167	MN -88	9:7180
3770169	NTIS (US Sales Only), PC A06/MF A01	DE83770169	MN -90	9:7181
3770170	NTIS (US Sales Only), PC A04/MF A01; 1	DE83770170	MN -12	9:8561
3770171	NTIS (US Sales Only), PC A08/MF A01; 1	DE83770171	MN -59	9:7416
3770173	NTIS (US Sales Only), PC A09/MF A01; 1	DE83770173	MN -95d	9:7704
3770174	NTIS (US Sales Only), PC A08/MF A01; 1	DE83770174	MN -38	9:7831
3770175	NTIS (US Sales Only), PC A02/MF A01; 1	DE83770175	MN -58d	9:7348
3770176	NTIS (US Sales Only), PC A07/MF A01; 1	DE83770176	MN -95d	9:7789
3770177	NTIS (US Sales Only), PC A04/MF A01	DE83770177	MN -98E	9:7790
3770178	NTIS (US Sales Only), PC A03/MF A01; 1	DE83770178	MN -98	9:7758
3770179	NTIS (US Sales Only), PC AX04/MF A01	DE83770179	MN -95f	9:7791
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4750088	NTIS (US Sales Only), PC A08/MF A01; 1	DE84750088	MN -95	9:7818
4750089	NTIS (US Sales Only), PC A04/MF A01; 1	DE84750089	MN -95	9:7819
4750090	NTIS (US Sales Only), PC A06/MF A01; 1	DE84750090	MN -90i	9:8547
4750112	NTIS (US Sales Only), PC A08/MF A01	DE84750112	MN -61a	9:7686
4750120	NTIS (US Sales Only), PC A05/MF A01; 1	DE84750120	MN -98F	9:7681
4770029	NTIS (US Sales Only), PC A02/MF A01	DE84770029	MN -11	9:8564
4770030	NTIS (US Sales Only), PC A99/MF A01; 1	DE84770030	MN -90	9:7696
4770031	NTIS (US Sales Only), PC A05/MF A01; 1	DE84770031	MN -61a	9:8467
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4770033	NTIS (US Sales Only), PC A02/MF A01	DE84770033	MN -98F	9:7666
4770034	NTIS (US Sales Only), PC A02/MF A01	DE84770034	MN -98F	9:7667
4770035	NTIS (US Sales Only), MF A01; 2	DE84770035	MN -98F	9:7668
4770036	NTIS (US Sales Only), PC A02/MF A01	DE84770036	MN -98F	9:7669
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4770038	NTIS (US Sales Only), PC A03/MF A01; 1	DE84770038	MN -90	9:7182
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4770040	NTIS (US Sales Only), PC A06/MF A01	DE84770040	MN -88	9:8657
4770041	NTIS (US Sales Only), PC A06/MF A01	DE84770041	MN -90	9:7184
4770042	NTIS (US Sales Only), PC A02/MF A01	DE84770042	MN -98F	9:7671
4770043	NTIS (US Sales Only), PC A02/MF A01	DE84770043	MN -98F	9:7672
4770044	NTIS (US Sales Only), PC A02/MF A01	DE84770044	MN -98F	9:7673
4770045	NTIS (US Sales Only), PC A02/MF A01	DE84770045	MN -98F	9:7674
4770046	NTIS (US Sales Only), PC A03/MF A01	DE84770046	MN -98F	9:7675
4770047	NTIS (US Sales Only), PC A02/MF A01	DE84770047	MN -98F	9:7676
4770048	NTIS (US Sales Only), PC A02/MF A01	DE84770048	MN -98F	9:7677
4770049	NTIS (US Sales Only), PC A02/MF A01; 1	DE84770049	MN -98F	9:7678
4770050	NTIS (US Sales Only), PC A06/MF A01	DE84770050	MN -98F	9:7679
4900383	NTIS, PC A02/MF A01; 1	DE84900383	MN -61a	9:7726
4900391	NTIS, PC A03/MF A01; 1	DE84900391	MN -98A	9:7168
4900393	NTIS, PC A02/MF A01	DE84900393	MN -98	9:7682
4900395	NTIS, PC A02/MF A01	DE84900395	MN -98C	9:7687
4900396	NTIS, PC A02/MF A01	DE84900396	MN -98B	9:7216
4900397	NTIS, PC A02/MF A01; 1	DE84900397	MN -98B	9:7711
4900499	Minerals Management Service, 3301 N. Causeway Blvd., Metairie, LA 70002		MN -11	9:8566
4900612	NTIS, PC A03/MF A01; 1	DE84900612	MN -91	9:7243
NRL-MR-				
5076	*See* AD-A-131628/0			9:8235

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5138	*See* AD-A-131592/8			9:8294
5219	NTIS, PC A03/MF A01	DE84004027	MN -21	9:9156
NUREG-				
1010	NTIS, PC A04/MF A01; 1 - GPO $4.50	DE83903089	MN -80	9:7587
NUREG/CP-				
0045-Vol.1	NTIS, PC A14/MF A01; 1 - GPO	DE84000514	MN -77	9:7635
NUREG/CR-				
2000-Vol.2-No.11	NTIS, PC A07/MF A01 - GPO	DE84004051	MN -80	9:7645
2078	NTIS, PC A99/MF A01 - GPO $15.00	DE84004160	MN -15	9:7315
2462	NTIS, PC A06/MF A01; 1 - GPO	DE84004271	MN -80	9:7558
2621	NTIS, PC A99/MF A01; 1 - GPO $14.00	DE84004279	MN -11	9:8548
2813	NTIS, PC A02/MF A01 - GPO $3.50	DE84004563	MN -70B	9:7281
2937	NTIS, PC A15/MF A01 - GPO $7.50	DE84004275	MN -70	9:7282
2970-Vol.4	NTIS, PC A07/MF A01	DE84004549	MN -78	9:7646
3081	NTIS, PC A03/MF A01 - GPO $3.75	DE84004223	MN -78	9:7559
3088	NTIS, PC A04/MF A01; 1 - GPO $4.50	DE84004661	MN -16	9:7316
3125	NTIS, PC A05/MF A01 - GPO $4.75	DE84004659	MN -70B	9:7308
3129	NTIS, PC A22/MF A01; 1 - GPO $9.50	DE84004280	MN -70	9:7283
3168	NTIS, PC A06/MF A01 - GPO $6.00	DE84004222	MN -70	9:7284
3256	NTIS, PC A05/MF A01 - GPO $4.50	DE84004272	MN -15	9:7317
3344	NTIS, PC A10/MF A01; 1 - GPO $6.50	DE84004562	MN -11	9:8530
3347-Vol.1	NTIS, PC A07/MF A01; 1 - GPO $7.00	DE84004270	MN -15	9:7318
3347-Vol.3	NTIS, PC A04/MF A01 - GPO $4.25	DE84004281	MN -15	9:7319
3348	NTIS, PC A04/MF A01 - GPO $4.50	DE84004282	MN -15	9:7320
3349	NTIS, PC A06/MF A01; 1 - GPO $4.75	DE84004285	MN -15	9:7321
3353	NTIS, PC A05/MF A01 - GPO	DE84004283	MN -70	9:7285
3368	NTIS, PC A03/MF A01 - GPO $3.75	DE84004277	MN -11	9:8531
3395	NTIS, PC A03/MF A01 - GPO $3.75	DE84004273	MN -70	9:7309
3408	NTIS, PC A08/MF A01; 1 - GPO $6.00	DE84004274	MN -11	9:8549
3439-Vol.1	NTIS, PC A04/MF A01 - GPO	DE84003867	MN -78	9:7573
3444-Vol.1	NTIS, PC A06/MF A01 - GPO	DE84004224	MN -78	9:7286
3482	NTIS, PC A02/MF A01 - GPO	DE84004182	MN -80	9:7560
3483	NTIS, PC A03/MF A01 - GPO	DE84004886	MN -80	9:7647
3501	NTIS, PC A04/MF A01 - GPO	DE84004554	MN -80	9:7701
3502	NTIS, PC A05/MF A01 - GPO	DE84004700	MN -80	9:7493
3538	NTIS, PC A08/MF A01 - GPO	DE84004072	MN -80	9:7648
OEFZS-				
4219	NTIS (US Sales Only), PC A03/MF A01	DE83704105	MN -4	9:8069
ONWI-				
479	NTIS, PC A09/MF A01	DE84004139	STD -70	9:7287
ORAU/IEA-				
83-10(M)	NTIS, PC A02/MF A01	DE84004063	MN -13	9:7792
ORNL-				
5691	*See* NUREG/CR-2621	DE84004279	MN -11	9:8548
5854	NTIS, PC A07/MF A01	DE84004108	MN -11	9:8516
5891	NTIS, PC All/MF A01	DE84004107	MN -13	9:7494
5919	NTIS, PC A15/MF A01	DE84003152	STD -20	9:9157
5982	NTIS PC A04/MF A01	DE84004197	MN -95d	9:7759
5989	NTIS, PC A06/MF A01	DE84004110	MN -61a	9:7727
5995	NTIS, PC A03/MF A01	DE84004105	MN -90h	9:7918
6004	NTIS, PC A17/MF AO1	DE84004127	STD -34	9:8836
6008	NTIS, PC A09/MF A01	DE84004131	STD -90d	9:7084
6024	*See* NUREG/CR-3482	DE84004182	MN -80	9:7560
ORNL/CDIC-				
6	NTIS, PC A04/MF A01	DE84004109	MN -11	9:8517
ORNL/CON-				
136	NTIS, PC A07/MF A01	DE84004151	MN -95d	9:7771
139	NTIS, PC A04/MF A01	DE84004130	MN -95d	9:7772
ORNL/NSIC-				
200-Vol.2-No.11	*See* NUREG/CR-2000-Vol.2-No.11	DE84004051	MN -80	9:7645
ORNL/RSIC-				
46	NTIS, PC A02/MF A01	DE84004071	MN -13	9:9035
ORNL/SGMP-				
83/ 2	NTIS PC A08/MF A01	DE84004133	MN -90c	9:7117
ORNL/Sub-				
78-7229/ 4	NTIS, PC A04/MF A01	DE84005083	STD -95d	9:7773
82-22293/ 1	NTIS, PC A10/MF A01; 1	DE84004220	MN -95d	9:7774
ORNL/TM-				
8203	NTIS PC E05/MF A01	DE84002265	STD -79d	9:9036
8566	NTIS, PC A09/MF A01	DE84004132	MN -61a	9:7365
8672	NTIS, PC A05/MF A01	DE84004128	MN -11	9:8565
8684	*See* NUREG/CR-3501	DE84004554	MN -80	9:7701
8686	NTIS, PC A03/MF A01	DE84004152	MN -70A	9:7288
8698	NTIS, PC A04/MF A01	DE84004595	MN -41	9:9045
8775	NTIS, PC A03/MF A01; 1	DE84004123	STD -90d	9:7118
8777	NTIS, PC A05/MF A01; 1	DE84004204	MN -90d	9:7119
8794	*See* NUREG/CR-3502	DE84004700	MN -80	9:7493
8797	NTIS, PC A04/MF A01	DE84004111	MN -90	9:7120
8799	NTIS, PC A02/MF A01	DE84004124	MN -32	9:9203
8805	NTIS, PC A06/MF A01	DE84003372	MN -11	9:8594
8829	NTIS, PC A03/MF A01	DE84002255	MN -80	9:7588
8845	NTIS, PC A04/MF A01	DE84002410	MN -78	9:7561
8847	NTIS, PC A03/MF A01	DE84004106	MN -70B	9:7289
8862-V1	*See* NUREG/CR-3439-Vol.1	DE84003867	MN -78	9:7573
8866	NTIS, PC A02/MF A01	DE84004098	MN -70B	9:7290

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8897	NTIS, PC A04/MF A01	DE84004100	MN -70A	9:7291
8908	NTIS, PC A02/MF A01	DE84004163	MN -90c	9:7121
8943	NTIS, PC A02/MF A01	DE84004125	MN -4	9:9204
8969	NTIS, PC A02/MF A01	DE84004120	MN -80	9:7589
8979	NTIS, PC A03/MF A01; 4	DE84003362	MN -22	9:8157
ORNL-tr-				
5065	NTIS, PC A02/MF A01	DE84004835	MN -11	9:8532
ORO-				
2408-214	*See* DOE/ER/02408-214	DE84004052	MN -34A	9:8705
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PB-				
83-239459	NTIS, PC A09/MF A01			9:7835
83-239574	NTIS, PC A03/MF A01			9:8263
83-242537	NTIS, PC A11/MF A01			9:8534
83-243030	NTIS, PC A03/MF A01			9:7336
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83-244657	NTIS PC E04/MF E01			9:7821
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83-252437	NTIS, PC A02/MF A01			9:7346
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83-254946	NTIS PC E06			9:7187
83-256487	NTIS PC E04/MF			9:7185
PCCF-T-				
82-02	NTIS (US Sales Only), PC A04/MF A01	DE83704056	MN -34D	9:8812
82-03	NTIS (US Sales Only), PC A05/MF A01; 1	DE84750242	MN -11	9:8658
82-04	NTIS (US Sales Only), PC A03/MF A01; 1	DE84750215	MN -37	9:8448
PFC/RR-				
83-25	*See* DOE/ET/51013-96	DE84004649	STD -20	9:9078
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PIFR-				
1403	*See* AD-A-131174/5			9:8487
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PNL-				
4372	*See* NUREG/CR-3125	DE84004659	MN -70B	9:7308
4656	*See* NUREG/CR-3256	DE84004272	MN -15	9:7317
4753	*See* NUREG/CR-3344	DE84004562	MN -11	9:8530
4772	*See* NUREG/CR-3368	DE84004277	MN -11	9:8531
4776	*See* NUREG/CR-3395	DE84004273	MN -70	9:7309
4788	*See* NUREG/CR-3408	DE84004274	MN -11	9:8549
4882	NTIS, PC A04/MF A01; 1	DE84004149	MN -11	9:8645
4917	NTIS PC A06/MF A01	DE84004164	MN -96	9:8205
PNL-SA-				
11124	NTIS, PC A02/MF A01; 1	DE84002473	MN -86	9:7262
11300	NTIS, PC A02/MF A01; 1	DE84004832	MN -95a	9:7793
11381	NTIS, PC A02/MF A01	DE84001907	MN -78	9:7568
11396	NTIS, PC A02/MF A01	DE84004839	MN -80	9:7562
11436	NTIS, MF A01; 2	DE84004845	MN -25	9:7919
11561	NTIS, PC A03/MF A01; 1	DE84004831	MN -11	9:8520
11571	NTIS, PC A02/MF A01	DE84003957	MN -48	9:8616
11610	NTIS, PC A02/MF A01	DE84003261	MN -70	9:7307
11743	NTIS, PC A02/MF A01	DE84004850	MN -38	9:8226
11744	NTIS, PC A05/MF A01	DE84004842	MN -41	9:8630
11782	NTIS, PC A03/MF A01	DE84004838	MN -11	9:8543
11798	NTIS, PC A02/MF A01	DE84004844	MN -11	9:8521
11807	NTIS, PC A02/MF A01	DE84003344	MN -61a	9:7332
11924	NTIS, PC A05/MF A01	DE84005049	MN -11	9:8550
PPG-				
722	*See* AD-A-131600/9			9:9073
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83-505	*See* DOE/ER/01428-502	DE84004570	MN -34D	9:8744

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83-508	See DOE/ER/01428-503	DE84004709	MN -34D	9:8745
RCO-				
6	NTIS (US Sales Only), PC A99/MF A01	DE84700208	MN -25	9:7920
RDA-TR-				
125004-003	See AD-A-131489/7			9:8494
RHO-PB-SR-				
10-B-WM-Nov.83	NTIS, PC A05/MF A01; 1	DE84004205	MN -70	9:7292
RISO-M-				
2390	NTIS (US Sales Only), PC A03/MF A01	DE84750080	MN -13	9:7683
2394	NTIS (US Sales Only), PC A04/MF A01; 1	DE84750085	MN -92	9:7205
RISO-R-				
484	NTIS (US Sales Only), PC A03/MF A01	DE84750082	MN -98F	9:7684
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82-059	See PB-83-243451			9:8685
82-084	NTIS (US Sales Only), PC A02/MF A01	DE83704152	MN -28	9:8353
82-092	NTIS (US Sales Only), PC A03/MF A01	DE83704062	MN -34D	9:8771
82-108	NTIS (US Sales Only), PC A02/MF A01	DE83704063	MN -34D	9:8772
82-110	NTIS (US Sales Only), PC A02/MF A01	DE83704057	MN -34D	9:8813
82-112	NTIS (US Sales Only), PC A04/MF A01	DE83704066	MN -46	9:9037
82-113	NTIS (US Sales Only), PC A03/MF A01	DE83704153	MN -28	9:8449
SAM-TR-				
83-30	See AD-A-131847/6			9:8595
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82-0767	See NUREG/CR-3088	DE84004661	MN -16	9:7316
82-2105	See NUREG/CR-2937	DE84004275	MN -70	9:7282
82-2223	See NUREG/CR-3129	DE84004280	MN -70	9:7283
83-0844	NTIS, PC A03/MF A01	DE84004137	MN -66c	9:7460
83-1062C	NTIS, PC A02/MF A01	DE84004065	MN -25	9:8027
83-1250	See NUREG/CR-2462	DE84004271	MN -80	9:7558
83-1258	See NUREG/CR-3538	DE84004072	MN -80	9:7648
83-1342	See NUREG/CR-3353	DE84004283	MN -70	9:7285
83-1346	NTIS, PC A02/MF A01	DE84004140	MN -32	9:9205
83-1582C	NTIS, PC A02/MF A01	DE84004069	MN -4	9:8128
83-1810C	NTIS, PC A02/MF A01	DE84001784	MN -80	9:7649
83-1868C	NTIS, PC A02/MF A01; 1	DE84004068	MN -80	9:7650
83-1911C	NTIS, PC A02/MF A01	DE84003209	MN -80	9:7651
83-1930	NTIS, PC A03/MF A01; 1	DE84004121	MN -78	9:7652
83-2005	NTIS, PC A03/MF A01	DE84004136	MN -92	9:7221
83-2540C	NTIS, PC A02/MF A01; 1	DE84004148	MN -4	9:8070
83-2592C	NTIS, PC A02/MF A01	DE84004422	MN -71	9:7263
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83-7081-Vol.1	See NUREG/CR-3347-Vol.1	DE84004270	MN -15	9:7318
83-7081-Vol.3	See NUREG/CR-3347-Vol.3	DE84004281	MN -15	9:7319
83-7082	See NUREG/CR-3349	DE84004285	MN -15	9:7321
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1	See AD-A-131793/2			9:8697
SERI/SP-				
281-1692	NTIS, PC A10/MF A01; 1	DE84003024	MN -59c	9:7417
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80/ T/ 222	NTIS (US Sales Only), PC A04/MF A01	DE84750050	MN -38	9:8258
SI-R-				
820808-1	NTIS (US Sales Only), PC A03/MF A01	DE84750117	MN -92	9:8043
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1982:5	NTIS (US Sales Only), PC A04/MF A01; 1	DE84750115	MN -97a	9:8639
1982:6	NTIS (US Sales Only), PC A02/MF A01	DE84750116	MN -48	9:8640
SKBF-KBS-TR-				
82-06	NTIS (US Sales Only), PC A04/MF A01	DE83704190	MN -70	9:7293
SLAC-CN-				
251	NTIS, PC A02/MF A01; 1	DE84003222	MN -28	9:8312
253	NTIS, PC A02/MF A01; 1	DE84003223	MN -28	9:8313
254	NTIS, PC A02/MF A01	DE84004228	MN -28	9:8314
256	NTIS, PC A02/MF A01	DE84004250	MN -28	9:8368
257	NTIS, PC A02/MF A01	DE84004605	MN -28	9:8292
259	NTIS, PC A02/MF A01	DE84005033	MN -28	9:8315
260	NTIS, PC A02/MF A01; 1	DE84004082	MN -28	9:8316
SLAC/FSDG-				
141	See CONF-8305146-	DE83017557	MN -32	9:9194
142	See CONF-8305146-	DE83017557	MN -32	9:9194
143	See CONF-8305146-	DE83017557	MN -32	9:9194
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3243	NTIS, PC A02/MF A01	DE84004600	MN -34D	9:8773
3248	NTIS, PC A02/MF A01	DE84003861	MN -34D	9:8774
SLU-IVL-				
137	NTIS (US Sales Only), PC A05/MF A01; 1	DE84750094	MN -61a	9:7366
138	NTIS (US Sales Only), PC A03/MF A01; 1	DE84750095	MN -61a	9:7367
SLU-IVL-UPPSATSER-				
120	NTIS (US Sales Only), PC A02/MF A01	DE84750096	MN -61a	9:7368
126	NTIS (US Sales Only), PC A02/MF A01	DE84750097	MN -90b	9:7169
SNV-PM-				
1449	See NE-FBA-83-3	DE84750111	MN -61a	9:8535
SOL-				
83-19	NTIS, PC A02/MF A01	DE84004639	MN -32	9:9206
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83/ 41	NTIS, PC A08/MF A01; 1	DE84001750	STD -59	9:7418

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SOLAR/0025-				
83/ 42	NTIS, PC A09/MF A01; 1	DE84003205	STD -59	9:7419
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83/ 14	NTIS, PC A04/MF A01	DE84000430	STD -59	9:7420
STF-				
15A82006	NTIS (US Sales Only), PC A02/MF A01; 1	DE84750121	MN -92b	9:7794
25A82006	NTIS (US Sales Only), PC A04/MF A01; 1	DE84750122	MN -92	9:7211
25A82009	NTIS (US Sales Only), PC A04/MF A01	DE84750123	MN -92	9:7212
TENRAC/EDF-				
086	NTIS, PC A05/MF A01	DE84900406	MN -59c	9:7421
088	NTIS, PC A07/MF A01; 1	DE84900419	MN -59c	9:7422
TM-				
82/ 5	*See* PB-83-254946			9:7187
TRI-PP-				
83-101	NTIS (US Sales Only), PC A02/MF A01	DE84900513	MN -38	9:9061
TRW-				
38163-6001-UT-00	*See* AD-A-131147/1			9:8486
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84/ 10	NTIS, PC A11/MF A01 - GPO	DE84900618	MN -94e	9:7775
UCID-				
16986-83-3	NTIS, PC A02/MF A01	DE84005137	MN -91	9:7244
17530-Rev.3	NTIS, PC A03/MF A01	DE84004602	MN -34	9:9088
19724	NTIS, PC A02/MF A01	DE84004597	MN -80	9:7483
19853	NTIS, PC A03/MF A01	DE84003913	MN -20	9:9165
19945	NTIS, PC A06/MF A01	DE84004701	MN -11	9:8536
19946	NTIS, PC A03/MF A01	DE84004703	MN -21	9:8469
19947	NTIS, PC A08/MF A01; 1	DE84005058	MN -32	9:9207
19954	NTIS, PC A03/MF A01	DE84004367	MN -32	9:9208
19965	NTIS, PC A04/MF A01	DE84005059	MN -28	9:8317
19969	NTIS, PC A02/MF A01	DE84005112	MN -32	9:9209
30197	NTIS, PC A03/MF A01	DE84004159	MN -32	9:9210
UCRL-				
15572	NTIS, PC A07/MF A01; 1	DE84004821	MN -32	9:9070
50051-83-1	NTIS, PC A04/MF A01	DE84002687	STD -20	9:9166
52971	NTIS, PC A03/MF A01	DE84004740	MN -21	9:8243
53445	NTIS, PC A04/MF A01; 1	DE84004138	MN -11	9:8663
53458	NTIS, PC A06/MF A01	DE84004599	MN -25	9:7968
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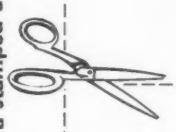

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